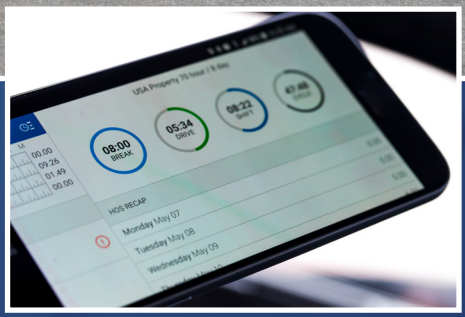
Costs and Consequences of Truck Driver Detention: A Comprehensive Analysis

September 2024



Prepared by the American Transportation Research Institute

ATRI American Transportation Research Institute

Costs and Consequences of Truck Driver Detention: A Comprehensive Analysis

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LIST OF ACRONYMS

ATRI	American Transportation Research Institute
BTS	Bureau of Transportation Statistics
CMV	Commercial Motor Vehicle
CI	Confidence Interval
ELD	Electronic Logging Device
FAST Act	Fixing America's Surface Transportation Act
FMCSA	Federal Motor Carrier Safety Administration
FMI	Freight Mobility Initiative
GPS	Global Positioning System
HOS	Hours-of-Service
ICs	Independent Contractors
LTL	Less-than-Truckload
MATS	Mid-America Trucking Show
MPH	Miles Per Hour
NCSU	North Carolina State University
OOs	Owner-Operators
OOIDA	Owner-Operator Independent Driver Association
RAC	Research Advisory Committee
RPM	Revolutions Per Minute
U.S. DOT	United States Department of Transportation
VIUS	Vehicle Inventory and Use Survey
VTTI	Virginia Tech Transportation Institute

INTRODUCTION

Truck driver detention is the additional time a commercial motor vehicle (CMV) driver must wait at a customer facility to pick up or deliver freight beyond their scheduled appointment time. Driver detention is regularly voted as a top issue in the industry, and in 2023 it was the fifth-highest issue for drivers specifically.[1] The Federal Motor Carrier Safety Administration (FMCSA) has also repeatedly identified detention as an area of concern over the past decade, including an audit as part of 2015's Fixing America's Surface Transportation Act (FAST Act) and the commencement in 2024 of an as-yet-unpublished study on the *Impact of Driver Detention Time on Safety and Operations*.[2]

The time drivers spend at customer facilities can be classified as either slack time or dwell time, with dwell time consisting of active operations and detention.

1. Slack Time. Any time a driver spends at a customer facility prior to scheduled arrival is slack time; this may or may not include intentional early arrival for planned breaks. In this report, slack time is not measured as part of dwell time.
2. Dwell Time. All time spent at a customer facility between scheduled arrival and actual departure.
    1. Active Operations. Any time spent loading, unloading, or conducting other necessary tasks for the pick-up or drop-off of freight.
    2. Detention. While any time spent at a customer facility in which a driver is waiting for active operations to commence or resume is operationally considered detention, this research follows a standard industry definition of detention as any dwell time longer than 2 hours.

Detention can take many forms. It may be caused by scheduling issues on the customer's part, inadequate parking and dock space, inadequate staffing at customer facilities, or upstream delays in production. In some cases, it may be caused by drivers' late arrivals, either due to driver/motor carrier delays or to factors outside of their control such as weather or unexpected road delays.

The type and duration of detention time is also influenced by business models and commodities hauled. Less-than-Truckload (LTL) carriers tend to have very little detention time due to the nature of their operations, while refrigerated carriers tend to have higher than average detention due to the sensitive nature of the commodities they haul.

Hours-of-Service (HOS) regulations stipulate that CMV drivers spend no more than 14 hours on duty, of which no more than 11 can be spent driving.[3] As such, lengthy delays lead to a variety of cascading problems. For drivers, detention can result in a loss of income, uncomfortable

[1] "Critical Issues in the Trucking Industry – 2023," American Transportation Research Institute (October 2023), https://truckingresearch.org/2023/10/critical-issues-in-the-trucking-industry-2023/.
[2] "Audit Announcement – Commercial Motor Vehicle Loading and Unloading Delays," Office of Inspector General, U.S. Department of Transportation (June 15, 2016), https://www.oig.dot.gov/sites/default/files/FMCSA%20Loading%20and%20Unloading%20Delays%20Announcement%5E-6-15-16.pdf; "Agency Information Collection Activities; Approval of a New Information Collection Request: Impact of Driver Detention Time on Safety and Operations," *Federal Register* (February 16, 2024), https://www.federalregister.gov/documents/2024/02/16/2024-03256/agency-information-collection-activities-approval-of-a-new-information-collection-request-impact-of.
[3] "Hours of Service of Drivers," *Federal Register* (June 1, 2020), https://www.federalregister.gov/documents/2020/06/01/2020-11469/hours-of-service-of-drivers.

waits without access to bathrooms, and schedule delays that can disrupt sleep schedules. For motor carriers, detention interrupts network operations, adds extra costs, and impacts revenue potential. For the supply chain as a whole, detention can cause numerous large-scale inefficiencies, from lost labor productivity to unnecessary fuel consumption. Even customers, the primary source of driver detention, experience a variety of negative consequences such as delayed service, additional penalties and fees, and higher freight rates.

The costs of detention can, therefore, impact all supply chain participants. In recognition of this fact, the American Transportation Research Institute (ATRI) Research Advisory Committee (RAC) identified the quantification of the costs of detention as a top industry research priority in 2023.[4] This report undertakes two primary research tasks:

- The first was to update ATRI research from the past decade on driver detention.[5]
- The second was to quantify the costs of detention in terms of lost productivity, driver income, carrier revenue, and carrier costs.

Finally, a separate safety impact analysis was conducted by researchers at North Carolina State University (NCSU). While that research is still underway, highlights of the safety impact analysis are included in this report.

BACKGROUND

While driver detention is frequently discussed anecdotally, large scale research dedicated to the issue is less common. Three studies from the past ten years, in addition to ATRI's previous research, helped inform this study and are discussed in greater detail below.

A 2014 study conducted by the Virginia Tech Transportation Institute (VTTI) for FMCSA found an average detention time of 1.4 hours per stop beyond the 2 hours of presumed active operations.[6] Data used in the study represented individual stops from 31 carriers, sourced from two telematics vendors. Refrigerated carriers were found to have the longest average detention time (1.74 hours) and the highest frequency of stops with detention (28%). Medium-sized fleets (51-500 trucks) had the highest average detention time of any fleet size in the study at 1.54 hours per stop, but the authors acknowledged that this may partly be due to a relative lack of data from smaller fleets.

A 2018 study by the U.S. Department of Transportation (U.S. DOT) Office of Inspector General estimated that drivers lose between $1,281 and $1,534 in income per year as a result of detention.[7] However, this estimate was based on detention time data from 2013 and does not account for driver detention pay, which a growing percentage of carriers offered over the

[4] ATRI's Research Advisory Committee RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, government agencies, professional truck drivers, law enforcement, and academia. The RAC is charged with annually recommending a research agenda for the Institute.
[5] Erin Speltz and Dan Murray, "Driver Detention Impacts on Safety and Productivity," American Transportation Research Institute (September 2019), https://truckingresearch.org/2019/09/driver-detention-impacts-on-safety-and-productivity/.
[6] Naomi Dunn et al., *Driver Detention Times in Commercial Motor Vehicle Operations*, Federal Motor Carrier Safety Administration (December 2014), https://vtechworks.lib.vt.edu/server/api/core/bitstreams/69784772-2ea8-46a6-b4fa-29f5e8a5794f/content.
[7] "Estimates Show Commercial Driver Detention Increases Crash Risks and Costs, but Current Data Limit Further Analysis," U.S. Department of Transportation Office of Inspector General (January 31, 2018), https://www.oig.dot.gov/sites/default/files/FMCSA%20Driver%20Detention%20Final%20Report.pdf.

intervening decade. The study (based on the same 2013 data) found that 15 minutes of additional average dwell time increased expected crash rates by 6.2 percent. Finally, the study had a separate finding that every 5-percent increase in the number of stops with detention increased expected crash rates by 4.7 percent.

An annual survey by the Owner-Operator Independent Driver Association (OOIDA) Foundation provides additional valuable context on detention.[8] Only 49 percent of surveyed drivers – primarily Owner-Operators (OOs) – attempted to receive compensation for detention time in 2023, and those that did attempt to do so only received it on approximately 25 percent of their detained loads.

ATRI's 2019 report on detention used driver survey data from 2014 and 2018 to show that the frequency of stops involving detention increased by 11.2 percent during that four-year period.[9] Detention times were found to vary considerably based on demographic factors. Women were 83.3 percent more likely to experience detention times of 4 hours or more. The study also found that, while a majority of motor carriers charged fees to customers for time detained, the average detention fee was below the average per-hour operating cost. Additional research by ATRI and the OOIDA Foundation found that 34 percent of drivers experienced longer loading and unloading times as a result of the COVID-19 pandemic.[10]

METHODOLOGY

This report assumes that detention time is any time spent at a customer facility in excess of two hours. This assumption follows industry practice, as two hours is by far the most common contractual threshold for determining when customers become liable for detention fees (as shown in Figure 8). Responses to ATRI's motor carrier survey, discussed below, found that most carriers do not track the amount of time lost specifically to detention at each stop, and even the carriers that do track this information do not follow a universal standard.

There are two primary components of this research.

Component One: Economic/Operational Analysis

For the economic/operational impacts component, two primary data collection tasks were undertaken.

Truck Driver Survey

The first was a survey of truck drivers that was designed to largely replicate previous ATRI driver surveys from 2014 and 2018 (Appendix A). As in these past instances, the survey was administered online and at a major trucking convention, the 2024 Mid-America Trucking Show (MATS) in Louisville, KY. The survey generated a total of 587 driver responses. The

[8] "2023 Detention Time Survey," Owner-Operator Independent Driver Association Foundation (February 2024), https://www.ooida.com/wp-content/uploads/2024/02/2023-Detention-Time-Survey-FINAL.pdf.
[9] Erin Speltz and Dan Murray, "Driver Detention Impacts on Safety and Productivity," American Transportation Research Institute (September 2019), https://truckingresearch.org/2019/09/driver-detention-impacts-on-safety-and-productivity/.
[10] "COVID-19 Impacts on the Trucking Industry," American Transportation Research Institute and Owner-Operator Independent Driver Association Foundation (April 2020), https://truckingresearch.org/2020/05/atri-and-ooida-covid-19-impacts-on-the-trucking-industry/.

demographic composition of the sample was very similar to that of the previous driver surveys.[11] Employee drivers made up 58 percent of respondents, while 18 percent were Owner-Operators with their own authority and 23 percent were OOs or Independent Contractors (ICs) leased to a motor carrier. Women were 10 percent of the sample, and men were 88 percent. Among drivers, 47 percent operated truckload dry vans, 20 percent operated refrigerated vans, and 28 percent operated other specialized trailer types.

For-Hire Motor Carrier Survey

The second economic/operational data collection task was a survey of for-hire motor carriers, administered online in the first quarter of 2024 (Appendix B). There was a total of 245 motor carrier responses. Truckload fleets made up 30 percent of responses, refrigerated fleets made up 24 percent of responses, and specialized fleets made up 42 percent of responses.

Several steps were taken to evaluate and mitigate the bias associated with convenience samples. T-tests were used to evaluate online driver surveys compared to in-person driver surveys, and no statistically significant differences were found in the frequency of stops with detention. Similarly, surveyed motor carriers' average dwell times were compared to average dwell times collected as part of ATRI's *Operational Costs of Trucking* report, in which dwell time-related bias plays no role in response rate.[12] The means of these two dwell time samples were not found to have a statistically significant difference.

ATRI also worked with several business associations to collect customer perspectives in the form of a short survey. This information helped inform assessments throughout the report.

Additional data was sourced from the U.S. Census Bureau's most recent Vehicle Inventory and Use Survey (VIUS), Argonne National Laboratory idling research, and ATRI's *Operational Costs of Trucking* report.[13]

Component Two: Relationship Between Detention and Truck Speeds

The second research component analyzed the relationship between truck driver detention and pre- and post-detained truck speeds. ATRI worked closely with its research partner NCSU to develop a sound methodology for understanding the relationship between detention and trucks speeds, utilizing ATRI's truck GPS data.[14] ATRI then geofenced different business facility types and captured data for trucks using those facilities. NCSU ran statistical tests on the data, based on truck time spent at each facility and mean truck speeds before and after a facility stop.

[11] For demographic breakdowns of these previous samples, see Erin Speltz and Dan Murray, "Driver Detention Impacts on Safety and Productivity," American Transportation Research Institute (September 2019), https://truckingresearch.org/2019/09/driver-detention-impacts-on-safety-and-productivity/.
[12] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.
[13] "2021 Vehicle Inventory and Use Survey (VIUS) Datasets: Public Use File," U.S. Bureau of Transportation Statistics and U.S. Census Bureau (December 28, 2023), https://www.census.gov/programs-surveys/vius.html; "How Much Fuel is Used for Idling?" Argonne National Laboratory (2014), https://www.anl.gov/sites/www/files/2018-02/idling_worksheet.pdf.
[14] Since 2002 ATRI has collected and processed truck GPS data and has used this data in support of myriad local, state, and federal freight analyses. At present, the ATRI GPS database is comprised of more than 1 million anonymized GPS-installed trucks in North America, and contains spot speeds, timestamp, location, and anonymous truck identifiers at regular intervals. This resource provides the research team unique access to information related to key truck origins and destinations, route choices, and speeds.

It should be noted that rounding is used in the figures and tables in this report.

OPERATIONAL AND ECONOMIC IMPACTS

Driver Detention Trends

Overall Detention Time Trends

Figure 1 compares for-hire drivers' detention times over the past decade by showing the average percentage of stops in each of three detention duration categories. To ensure consistency across all three years, drivers in private fleets and highly specialized fleets were excluded.[15]

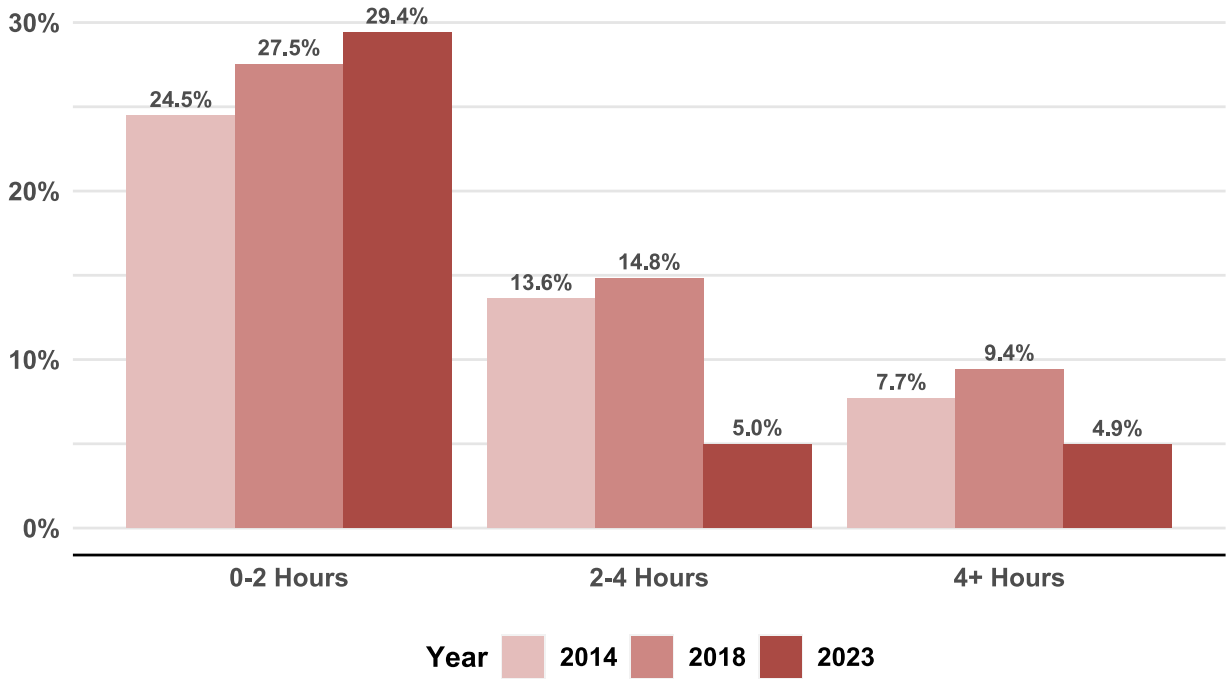
Detention Frequency is Decreasing. Data from ATRI's three driver surveys suggest moderate improvements in detention over the past decade. Altogether, the frequency of stops with detention dropped by 6.5 percentage points between 2014 and 2023. As detention time still occurs in some stops with less than two hours of dwell time, the true decrease in stops with detention thus is slightly less than 6.5 percentage points.

Duration of Detention is Improving. Significant detention of two hours or more became considerably less common, dropping by 11.4 percentage points between 2014 and 2023 (Figure 1). At the same time, however, detention times of up to two hours increased by 4.9 percentage points between 2014 and 2023.

Detention Remains Widespread. Even with these improvements, drivers experienced detention on 39.3 percent of stops in 2023. In 9.9 percent of stops – one in every ten – drivers experienced more than two hours of detention.

[15] As such, the percentages for 2014 and 2018 differ very slightly from what was published previously.

Figure 1: Driver Detention Time per Stop, 2014 – 2023

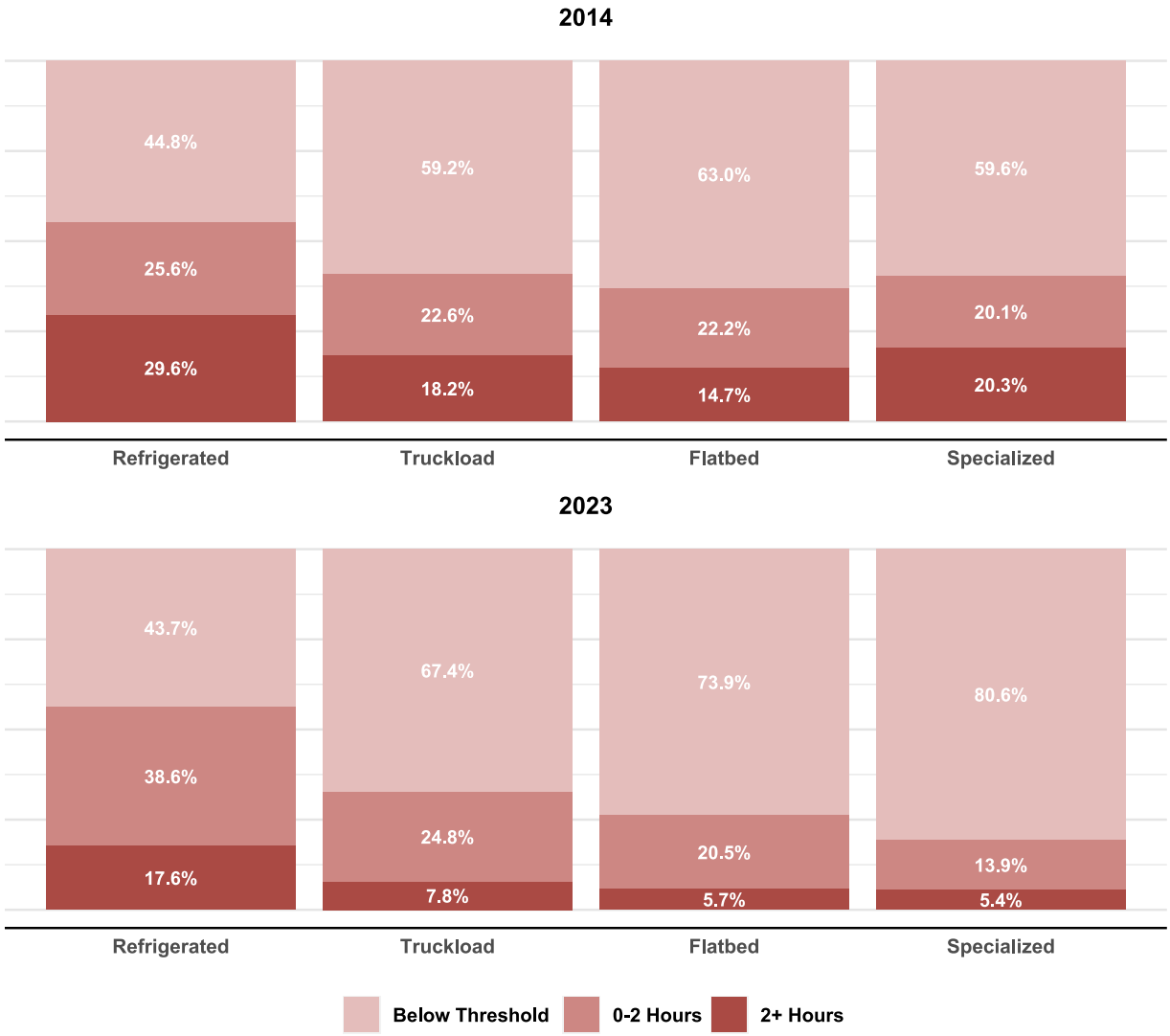


The 2023 detention time breakdowns reported by drivers parallel those reported by carriers, as discussed in the next section of this report.

Detention Differs by Sector

Sector has a significant impact on detention time per stop. As Figure 2 shows, drivers of refrigerated trailers experience the most detention time by far, with detention occurring in an average of 56.2 percent of stops in 2023. Truckload dry van drivers experienced detention time in an average of 32.6 percent of stops, while flatbed drivers experienced detention time in an average of 26.2 percent of stops and specialized drivers experienced detention time in an average of 19.3 percent of stops.

Figure 2: Driver Detention Time per Stop by Sector, 2014 and 2023



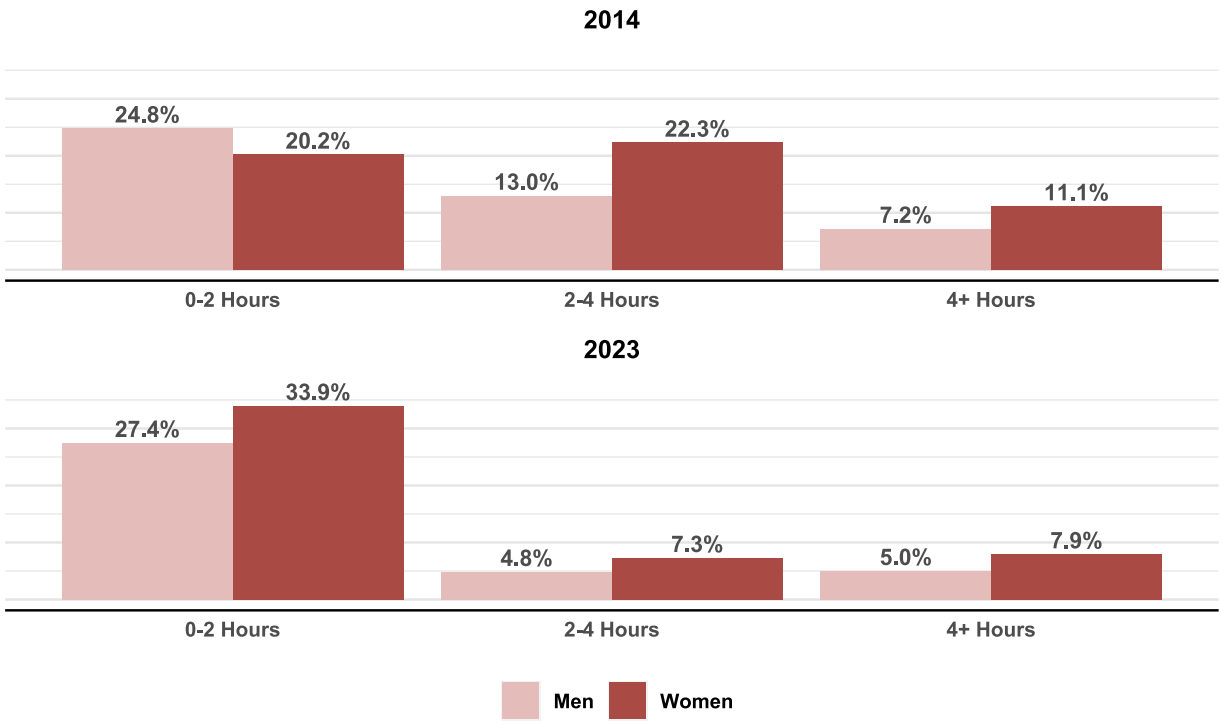
The general detention time trend over the past decade was observed, in varying degrees, in each sector. Detention times over two hours represented a much lower share of all stops in 2023 than in 2014 across all sectors, as shown in Figure 2. Stops with durations below the two-hour detention threshold made up a growing share of all stops in 2023 compared with 2014, though with greater variation by sector. Refrigerated trucks were the only sector to worsen, with a decrease of 1.1 percentage points in this category, while truckload and flatbed carriers each saw improvements of almost 10 percentage points in stops below the two-hour detention threshold.

Detention times of up to two hours were 13.0 percentage points higher among refrigerated drivers in 2023 compared to 2014 and 2.2 percentage points higher among truckload drivers. In contrast, flatbed drivers saw a dip of 1.7 percentage points in stops with up to two hours of detention time during the same period.

Gender Impacts Detention Times

Driver survey results again showed that women drivers experience detention more often and in longer duration. As Figure 3 shows, in 2023 women still experienced a greater share of stops in all three detention duration ranges. The gap between men and women did narrow between 2014 and 2023 in the longest detention time categories from a combined difference of 13.2 percentage points to 5.4 percentage points in stops with detention times over 2 hours. The gap between women and men in stops with detention times between 0 and 2 hours grew, however, to 6.5 percentage points in 2023.

Figure 3: Driver Detention Time per Stop by Gender, 2014 and 2023



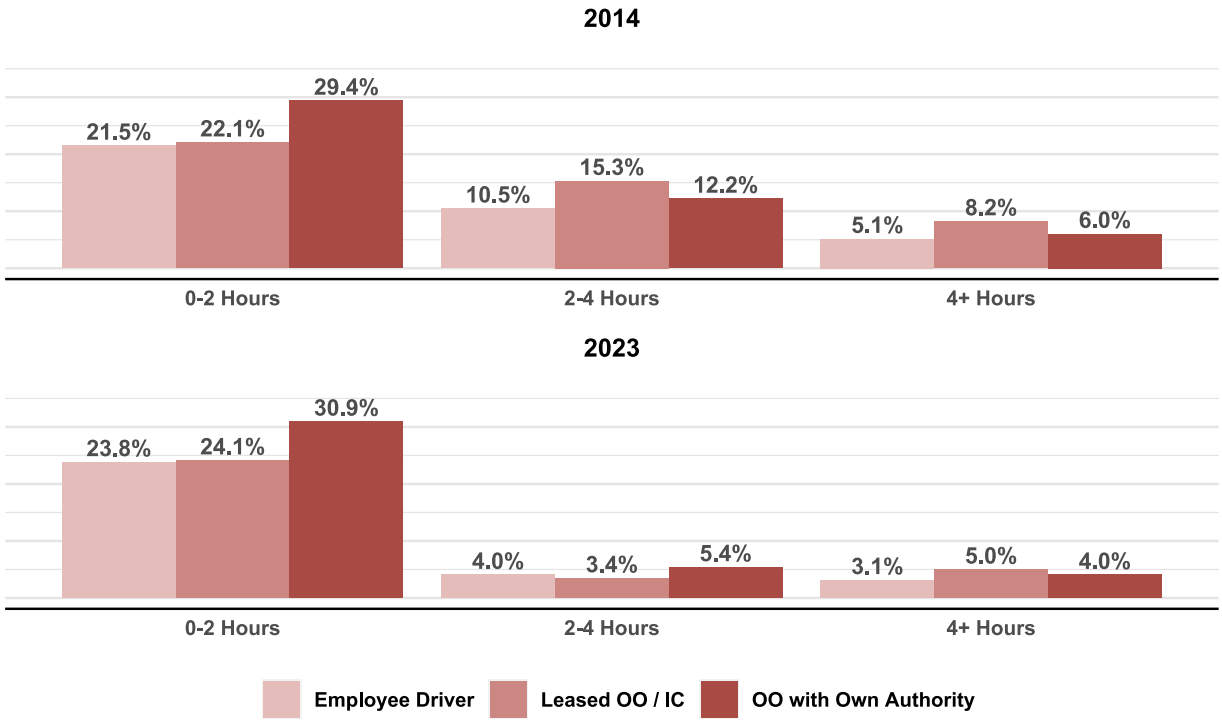
This tendency for women to experience detention more frequently was tested using linear regression, with a dummy variable representing gender as the independent variable and the combined average percentage of stops with detention as the dependent variable. The results confirmed that women were statistically more likely to experience detention than men in 2023 with a high level of confidence (p = 0.05). Additional models produced the same result (p = 0.05) even when independent demographic variables such as age and experience were also included.

Though men and women drivers both experienced improvements in detention times over the past decade, this persistent gender discrepancy is an area of top concern, especially for motor carriers seeking to employ and retain more women.

Company Drivers Detained Less Frequently

There were some moderate differences in average detention times based on a driver's employment status. In both 2014 and 2023, employee drivers had the lowest percentage of stops with detention (Figure 4). OOs with their own authority had the highest percentage of stops with detention times between zero and two hours.

Figure 4: Driver Detention Time per Stop by Driver Type, 2014 and 2023



In general, detention times were relatively consistent across driver types. Drivers of all employment statuses experienced the general trend of an increase in detention lasting up to two hours and a decrease in detention lasting two or more hours, where there was little differentiation between driver types in 2023. T-tests and linear regression did not find statistically significant differences between these three driver types based on the percentage of stops with detention.

Spot Market Freight Detained More Often

The type of load contract – contract freight versus spot market freight – appears to have a greater impact on detention, and likely explains why detention was more common for OOs, who tend to rely more on the spot market. In the motor carrier survey, respondents reported that 33.8 percent of stops associated with contract freight experienced detention compared with 42.5 percent of stops associated with spot market freight, with a statistically significant difference in means ($p < 0.05$).

A second test using linear regression had similar results. In this test, the dependent variable was each carrier's percentage of detained loads while the independent variable was the

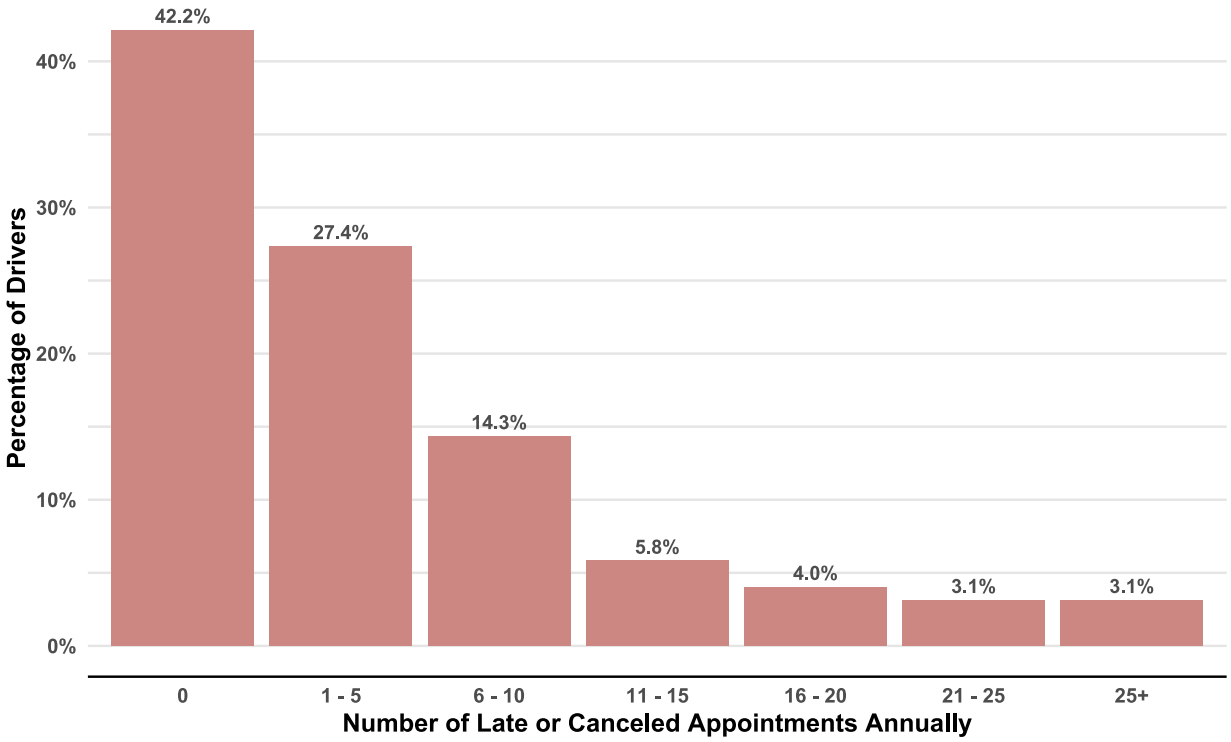
percentage of each carrier's loads sourced from the spot market. LTL carriers and OOs were excluded in order to minimize confounding variables. Carriers with greater utilization of the spot market experienced more detention with a moderate degree of statistical significance (p = 0.06).

Detention Harms HOS Management

Delays at customer facilities can significantly disrupt driver schedules and carrier operations. In this section, the analysis focused exclusively on drivers of truckload dry vans.

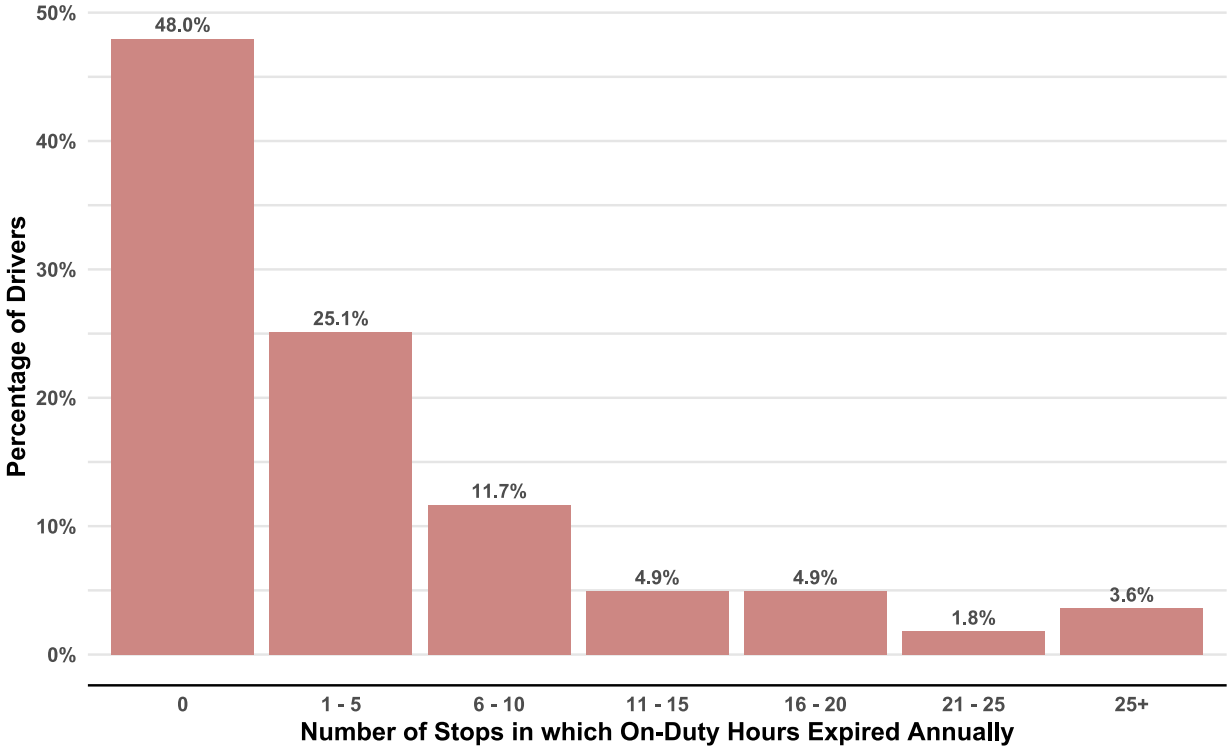
A majority of truckload drivers – 57.8 percent – were late to or had to cancel a pick-up or delivery due to detention at the previous customer's facility at least once in 2023. Figure 5 shows how frequently stops were delayed by detention in 2023. For example, 16 percent of drivers experienced more than 10 late arrivals caused by detention.

Figure 5: Late or Canceled Appointments Caused by Detention



Furthermore, a majority of truckload drivers – 52 percent – ran out of available HOS on-duty time at a customer facility due to detention. This can be especially problematic because it may disrupt the driver's entire weekly schedule in addition to making them late for their next appointments. Figure 6 shows how frequently drivers' on-duty time expired at customer facilities due to detention. For example, 15.2 percent of drivers ran out of on-duty hours due to detention on more than ten occasions.

Figure 6: HOS On-Duty Time Expiration at Customer Facilities Caused by Detention



Both of these detention outcomes cause cascading effects in the supply chain that negatively and directly impact customers and consumers. If detention during a pick-up causes a late drop-off elsewhere, it may lead to detention at that next facility as well, which could in turn snowball into still more late arrivals and detention. A driver whose available on-duty time expires at a customer facility will likely face truck parking issues (routinely ranked as drivers' top concern), may need to go without amenities for the night, or might have to wake up earlier to make up for the lost time and mileage at their next appointment.[16]

Detention Creates Other Work Challenges

Detention costs drivers time, money, and peace of mind. Drivers reported that an average of 50 percent of customer facilities do not allow drivers to park in the facility while waiting to load or unload. Without space to park, drivers may be forced to burn unnecessary fuel idling in both hot and cold weather conditions, park in undesignated or potentially unsafe areas, and lose valuable on-duty time seeking parking elsewhere – which may in turn cause further delays when returning to the customer facility.

Drivers reported that an average of 44 percent of customer facilities do not allow drivers to use bathroom facilities of any kind while waiting to load or unload. This prohibition becomes a significant discomfort and raises potential medical issues, and it can be particularly troublesome for women drivers – given their greater likelihood of detention.[17] Recent legislation passed in

[16] "Critical Issues in the Trucking Industry – 2023," American Transportation Research Institute (October 2023), https://truckingresearch.org/2023/10/critical-issues-in-the-trucking-industry-2023/.
[17] Hannah Towey and Grace Kay, "Trucks say they're denied bathrooms on the job, forcing female drivers to take creative measures to relieve themselves" *Business Insider* (February 7, 2022),

Washington state and introduced at the federal level has aimed to address this problem by requiring customer facilities to grant drivers access to employee or customer bathrooms when delivering freight.[18]

Ideally, customers would allow drivers access to a lounge, break room, or waiting area to prevent these issues, but drivers reported that 78 percent of customer facilities, on average, do not provide any such space.

Detention Contributes to Turnover

Detention impacts drivers in myriad ways, so it comes as little surprise that detention plays a role in truck drivers' career decisions. In 2023, 34.6 percent reported that they had left a previous driving job in the past as a result of excessive or undercompensated detention time. As Table 1 shows, this percentage is partly skewed by years of experience in the industry.

Table 1: Drivers Who Quit Previous Driving Job Because of Detention by Years of Driving Experience, 2023

5 or Fewer Years	6 to 10 Years	More than 10 Years
22%	30%	38%

Drivers with five or fewer years in the industry have less experience with detention than their longer-tenured peers and less leverage in the job market (since many carriers do not hire drivers with fewer than two years of experience), yet 22 percent of newer drivers had already left at least one carrier due to detention woes.

A substantially higher percentage of drivers (45.2%) in the refrigerated sector reported that they had left a previous carrier due to detention. Otherwise, detention-related turnover was relatively consistent across sectors.

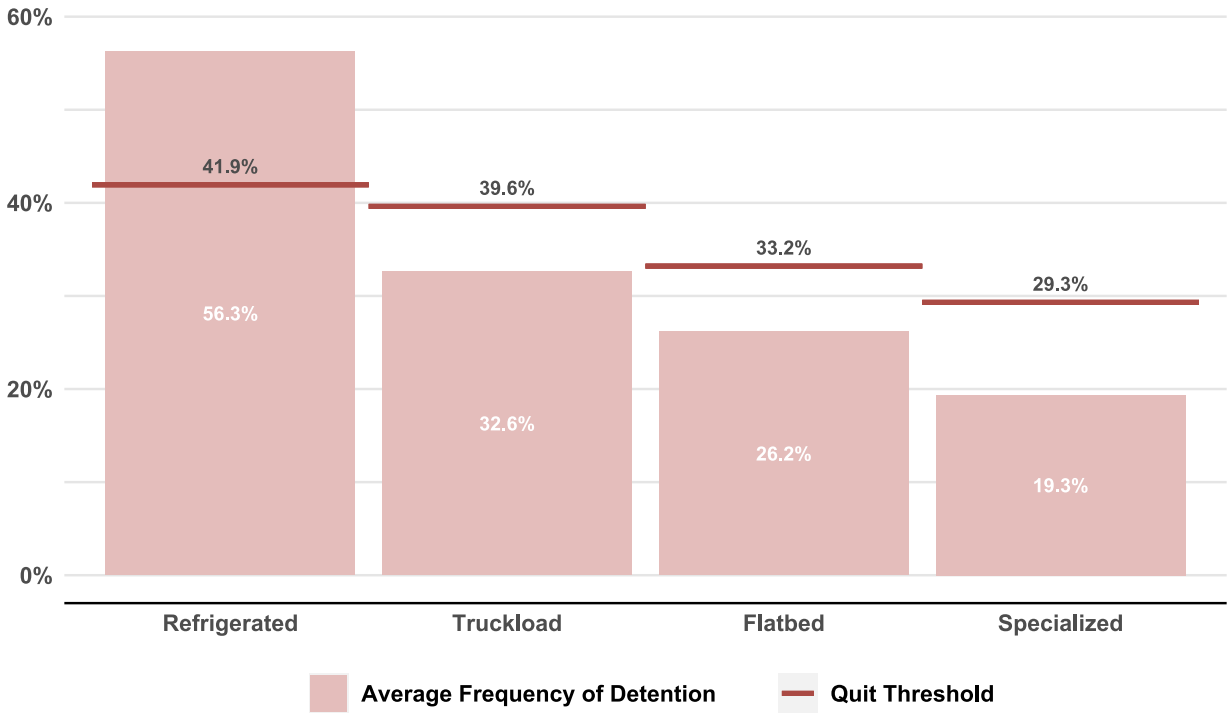
Drivers were also asked how frequent detention would need to become in order for them to change jobs.[19] Figure 7 compares the current average percentage of stops with detention (as columns) to the average threshold at which drivers would seek to change jobs (as horizontal lines) for each sector.

https://www.businessinsider.com/truckers-denied-bathroom-access-warehouses-restrooms-impact-on-female-drivers-2022-2; Abbigail Huffman and Alexandra Shirk, *Identify and Mitigating the Challenges Faced by Women Truck Drivers*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/identifying-and-mitigating-the-challenges-faced-by-women-truck-drivers/.

[18] Noël Fletcher, "Washington Passes Bathroom Access for Truckers Law," *Transport Topics* (May 22, 2023), https://www.ttnews.com/articles/washington-bathroom-truckers; John Worthen, "Trucker Bathroom Access Act gains new supporters," *The Trucker* (February 16, 2024), https://www.thetrucker.com/trucking-news/the-nation/trucker-bathroom-access-act-gains-new-supporters.

[19] While survey respondents can never be certain about their behavior in hypothetical future scenarios, comparing their perceptions to current conditions can be instructive – especially when so many respondents have experience with the scenario in question.

Figure 7: Average Driver Detention Frequency and Quit Thresholds by Sector, 2023



Refrigerated drivers were the only group where the threshold for seeking new employment – at 41.9 percent – was below the current average detention frequency of 56.3 percent of all stops – hence the higher percentage of drivers in this sector reporting that they had left a previous carrier due to detention.

Truckload drivers reported that they would seek different employment if 39.6 percent of their stops had detention, 7 percentage points higher than the sector's current average detention frequency of 32.6 percent of stops.

Flatbed drivers reported that they would seek different employment if 33.2 percent of their stops had detention, a threshold 7 percentage points higher than their current average detention frequency of 26.2 percent of stops.

While men on average said that their upper limit for detention was 35.0 percent of stops, women reported a much higher upper limit of 47.3 percent. This supports previous findings that women drivers tend to be more patient when detained and less likely to demand action.[20]

Expectations for inappropriate levels of detention do not appear to differ by age, however. Drivers aged 25 to 44 and drivers aged 45 to 64 each reported an average upper limit for detention of 36.0 percent.

[20] Erin Speltz and Dan Murray, "Driver Detention Impacts on Safety and Productivity," American Transportation Research Institute (September 2019), https://truckingresearch.org/2019/09/driver-detention-impacts-on-safety-and-productivity/.

Economic Costs of Driver Detention

Driver detention in the trucking industry leads to a variety of costs that negatively impact drivers, carriers, and the supply chain as a whole. This research analyzes detention costs across seven key categories and applies them to the three leading industry sectors.

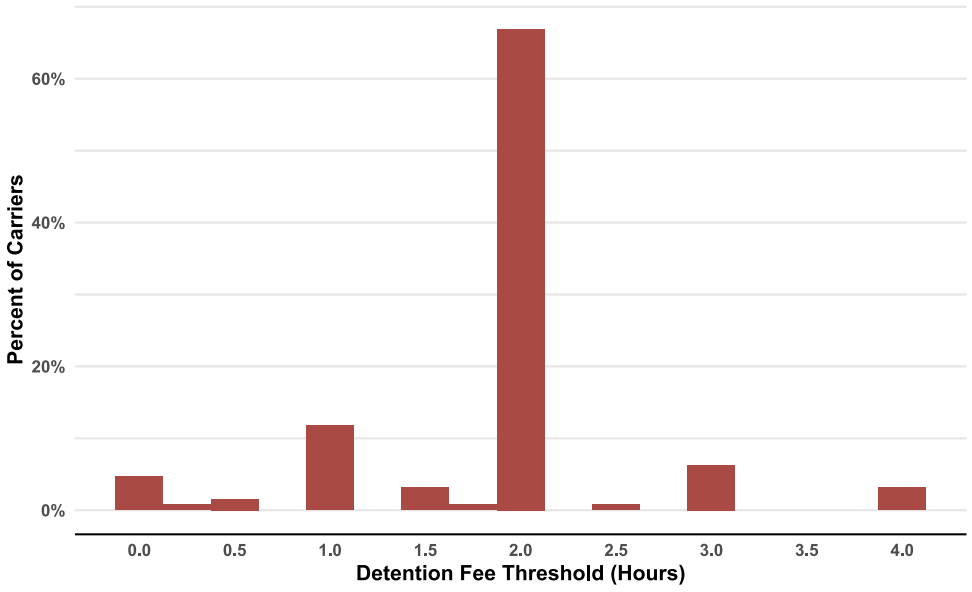
The three industry sectors used in analysis were truckload dry van, refrigerated, and specialized. The specialized group contains several sectors – flatbed, bulk, tankers, and intermodal. LTL carriers were not included in the analysis because their operational model is less impacted by frequent driver detention, and as such the sector generally does not consider detention a problem. OOs were also not included in this analysis because their experience of detention differs from that of employee drivers, as previously discussed. Unless otherwise stated, all data in this section comes from the motor carrier survey conducted as part of this report.

Defining Detention and Assumptions

As discussed in the Methodology section above, carrier responses showed that most carriers do not track the amount of true detention time at each stop. Carriers do, however, possess accurate data on the total amount of total dwell time at each stop via GPS or Electronic Logging Device (ELD) data.

As Figure 8 shows, 67 percent of carriers that charge detention fees do so starting at the two-hour mark (followed by 12% of carriers charging at the one-hour mark and 6% of carriers charging at the three-hour mark). As such, as a conservative estimate, this report utilized the definition of detention time as all delay in excess of two hours.

Figure 8: Detention Fee Start Time



The second step was to identify, for each sector, the median number of stops made by each driver in a typical week (pickups and deliveries). These were multiplied by an assumed 50 full work weeks in a year, as shown in Table 2.

Table 2: Median Total Stops per Driver

Sector	Stops per Week	Stops per Year
Refrigerated	5	250
Specialized	10	500
Truckload	8	400

This analysis primarily uses medians for calculation as they are less skewed by exceptionally high or low values than means. Truck-weighted averages were not used for a similar reason; if carrier data were weighted by truck counts, a small number of very large respondent fleets could potentially skew averages in a significantly non-representative manner. In testing these alternatives across various metrics, medians most often either aligned with other measures or occurred between them.

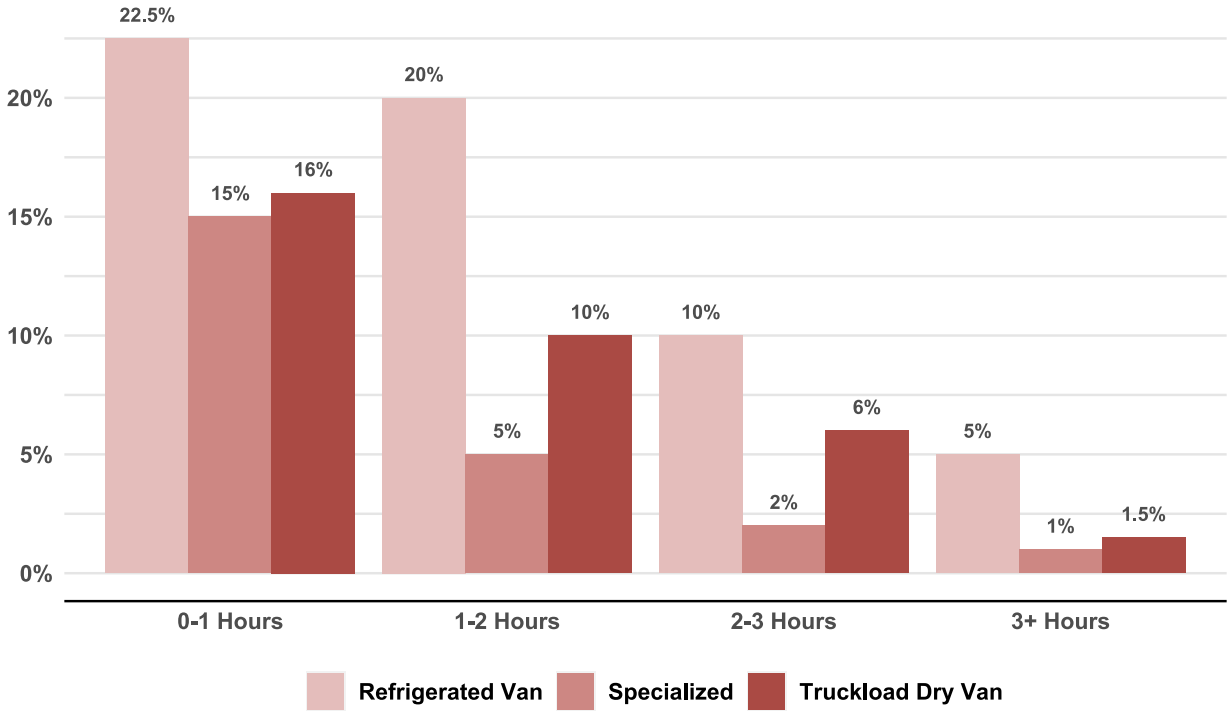
When calculating the time, money, and other resources lost during detention, it is assumed that carriers can maintain the same level of driver and asset utilization if detention times are eliminated. Whenever applicable, estimates were made conservatively to err on the side of underreporting rather than overreporting the costs of detention. As this section shows, detention is a substantial problem even when measured conservatively.

Lost Productivity

The most immediate cost of detention is lost revenue time that could otherwise be employed productively in freight delivery.

Carriers were asked to report the percentage of their stops (pickups and deliveries) by the number of hours of dwell time. Figure 9 shows the median percentage of stops corresponding to each duration of detention time, based on dwell time over two hours. Note that these percentages for each sector approximately parallel those reported by drivers in Figure 2. The remainder of stops not represented in this figure were assumed to have no detention time: 42.5 percent of refrigerated carriers, 77 percent of specialized carriers' stops, and 66.5 percent of truckload dry van carriers' stops.

Figure 9: Median Percentage of Carrier Stops with Detention by Hours Detained



The frequency of stops in each detention time range were next converted to the equivalent annual hours per driver.[21] Table 3 sums each of these bins to determine the total annual hours spent in detention per driver.

At an estimated 209.4 hours per driver, refrigerated drivers experienced the most detention at customer facilities in 2023, followed by truckload drivers' 173.0 hours of annual detention and specialized drivers' 117.5 hours of annual detention.

Table 3: Annual Detention Time per Driver and by Hourly Duration

Sector	Hours of 0-to-1 Hour Detention Stops	Hours of 1-to-2 Hour Detention Stops	Hours of 2-to-3 Hour Detention Stops	Hours of 3+ Hour Detention Stops	Annual Hours of Detention per Driver
Refrigerated	28.1	75	62.5	43.8	**209.4**
Specialized	37.5	37.5	25.0	17.5	**117.5**
Truckload	32.0	60.0	60.0	21.0	**173.0**

[21] The number of annual hours each driver spent detained in each time range was found by converting the frequencies in Figure 9 into the equivalent number of annual stops from Table 2 and then multiplying by the midpoint of each hourly range – for example, 1.5 for stops with 1 to 2 hours of detention – with 3.5 used for stops with more than 3 hours of detention. Midpoints were used rather than inferring an "average" time in each bin based on density curves because the data, at this resolution, does not clearly indicate an alternative distribution shape.

In other words, drivers in the truckload sector spend over 15 days' worth of HOS driving time (11 hours per day) in detention each year.

In order to estimate the total annual hours of detention, the number of Class 7 and 8 trucks operating in each sector was estimated using the U.S. Census Bureau's most recent VIUS data, from 2021.[22] As there were more tractor-trailers in use in 2023 than in 2021, this should again be considered a conservative estimate. Trucks primarily engaged in LTL shipments or traveling fewer than 20,000 annual miles were removed.[23]

The total annual hours of detention time for each sector and the industry overall in Table 4 were obtained by multiplying the VIUS total number of trucks in each sector by the corresponding annual hours of detention per driver (Table 3).

Table 4: Annual Industry-Wide Detention Time

Sector	VIUS Total Trucks	Total Detention Time (Hours)
Refrigerated	108,692	**22,760,105**
Specialized	343,135	**40,318,363**
Truckload	420,883	**72,812,759**
Overall	872,710	**135,891,227**

The for-hire trucking industry lost over 135 million productive hours in 2023 to driver detention at customer facilities. This glaring inefficiency has numerous consequences for the supply chain. More drivers and trucks must be utilized in order to compensate for these lost hours. Customers themselves, by causing detention, experience slower movement of goods in the supply chain.

Lost Asset Utilization

When drivers lose productive hours, equipment use – trucks and trailers – is also less efficient. To quantify this inefficiency, the annual hours lost to detention per driver were converted to the equivalent in lost mileage by using a GPS-derived average truck speed of 40.20 miles per hour (MPH) from the U.S. Bureau of Transportation Statistics (BTS)/ATRI Freight Mobility Initiative

[22] Another advantage of VIUS data is that truck counts are based on the primary trailer type hauled by each truck rather than the primary trailer type hauled by the carrier operating that truck; in other words, a truck hauling a refrigerated trailer owned by a truckload carrier is still counted toward the refrigerated sector. "2021 Vehicle Inventory and Use Survey (VIUS) Datasets: Public Use File," U.S. Bureau of Transportation Statistics and U.S. Census Bureau (December 28, 2023), https://www.census.gov/programs-surveys/vius.html.

[23] Data was filtered to only include for-hire, class 7 or 8 tractor-trailers that ran more than 20,000 annual miles. For-hire vehicles were identified via the primary commercial activity field. Using these filters, a separate step was taken to identify the proportion of trucks engaged primarily (more than 50% of the time) in less-than-truckload shipments, which was later removed; this was conducted as a separate step due to high nonresponse to this question and based on advisement in VIUS documentation. Trucks were associated with truckload dry vans if their primary trailer type was an enclosed van, an insulated nonrefrigerated van, or a container. Trucks hauling some specialized trailer types were excluded.

(FMI) program.[24] Table 5 includes this conversion to lost mileage, the average annual mileage driven per truck in 2023 (via ATRI's 2024 *Operational Costs* report), and the percentage of the total possible annual mileage (actual mileage plus lost mileage) that was lost.[25]

Table 5: Lost Annual Mileage Due to Detention

Sector	Lost Mileage	Actual Annual Mileage	% of Annual Mileage Lost
Refrigerated	8,418	103,094	**7.5%**
Specialized	4,724	77,088	**5.8%**
Truckload	6,955	87,280	**7.4%**

Therefore, a total elimination of delay time exceeding two hours would mean that the nation's truckload freight demand could be met with 7.4 percent fewer trucks running the same average annual mileage (Table 5).

This conclusion can be understood in one of two ways:

- Trucks and trailers run fewer annual miles than they should because of detention. Any improvement in detention times would significantly improve asset use, including the payback period for return-on-investment.
- More trucks and drivers are needed to maintain the freight status quo because of detention. Any improvement in delay time would significantly reduce necessary capital outlays for carriers at a time when improvements in propulsion and safety technology have driven up truck prices.

Lost Driver Income

Lost productivity also hurts drivers' bottom line. Many drivers in the refrigerated, specialized, and truckload sectors are paid on a per-mile basis, and HOS regulations prevent drivers from making up lost mileage by working extra hours under potentially unsafe conditions. As such, excessive detention times cut into drivers' income. A large majority of surveyed carriers – 96.9 percent – offer detention pay to their drivers to address this fact, but driver detention pay often does not fully compensate drivers for the per-mile pay they could have otherwise received.

Table 6 compares the median driver detention pay for each sector with the corresponding driver pay in 2023, converted to a per-hour average, as derived from ATRI's *Operational Costs of Trucking*.[26] The difference between the two is the amount of pay that drivers lose for every hour

[24] ATRI derived this speed by analyzing one full week of national FMI data in each of the four quarters in 2023 (the 12th to the 18th of February, May, August, and October). This dataset consisted of over 300 million truck speed data points with non-zero speeds. This speed figure represents an average operational speed since it includes speeds in all types of operational conditions, sectors, and locations.
[25] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.
[26] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.

of detention. Carrier-reported median driver detention pay rates in each sector were all broadly consistent with those reported by drivers in 2023.

The annual lost income per driver due to detention, also in Table 6, was calculated by multiplying the lost hourly driver pay per hour of detention by the annual hours of detention per driver in Table 3. Detention deprived drivers in the refrigerated sector of the most income, at $1,283.62 annually. Truckload drivers lost $889.22 each year to detention, and specialized drivers lost $640.38 each year to detention.

Table 6: Lost Driver Income Due to Detention

Sector	Average Driver Pay per Hour	Median Driver Detention Pay per Hour	Lost Driver Pay per Hour of Detention	Annual Lost Income per Driver
Refrigerated	$26.13	$20	$6.13	**$1,283.62**
Specialized	$34.45	$29	$5.45	**$640.38**
Truckload	$28.14	$23	$5.14	**$889.22**

In 2023, detention time uncompensated by detention pay amounted to approximately 1.6 percent of refrigerated drivers' annual pay, 0.9 percent of specialized drivers' annual pay, 1.2 percent of truckload drivers' annual pay.[27]

There are several reasons, described below, for why driver detention pay does not fully compensate drivers for the pay they could have otherwise received driving.

Inadequate Detention Fees

While a large majority of carriers – 94.5 percent – now charge a detention fee in at least some instances, a substantial proportion of detention is never actually billed. This is a marked increase from 2018, when 79.8 percent of carriers charged detention fees.[28] Furthermore, Table 7 shows that only a fraction of those billed detention fees are ever paid by customers. Truckload carriers, for example, did not bill in a median of 21 percent of incidents, and a median of 45 percent of truckload detention fees that were billed went unpaid.

Table 7 shows the total percentage of detention time that is unreimbursed. Overall, carriers invoiced customers 75 percent of the time, and only 55 percent of those invoices were paid.

[27] Lindsay Bur and Bob Costello, *ATA Driver Compensation Study* (August 2024),
Annual averages were drawn from the "refrigerated: solo drivers" for refrigerated, "total truckload" for truckload, and "flatbed" for specialized in lieu of an exact equivalent "specialized" category because flatbeds make up the largest share of specialized operations.
[28] Erin Speltz and Dan Murray, "Driver Detention Impacts on Safety and Productivity," American Transportation Research Institute (September 2019), https://truckingresearch.org/2019/09/driver-detention-impacts-on-safety-and-productivity/.

Table 7: Percentage of Detention Incidents Compensated by Detention Fees

Sector	% of Detention Incidents Billed	% of Billed Detention Fees Received by Carrier	% of All Incidents with Detention Fees Paid
Refrigerated	80.0%	45.0%	**36.0%**
Specialized	68.0%	67.5%	**45.9%**
Truckload	79.0%	55.0%	**43.5%**

There are many reasons why carriers may choose not to bill for detention. This choice may depend on a carrier's contract with a customer or their own internal policy. The duration of detention may, for instance, be below a requisite billable interval (e.g. 15 minutes) or considered too small to be worth the trouble. Alternatively, there may be a disqualifying factor. For example, a carrier may not be able to bill for detention if the driver was late to the scheduled appointment even if the amount of detention time was much longer than the amount of lateness. A carrier may decide not to bill for detention because they believe they will not actually receive detention fees from a particular customer, as can be seen in Table 7.

Finally, a carrier may avoid pressing a particular customer for detention fees if that customer is considered an important account. This concern may be more important to small carriers. All (100%) respondent fleets with more than 50 trucks reported charging detention fees, compared with 92 percent of fleets with 50 or fewer trucks – an increase from 2018, when 80 percent of fleets with 50 or fewer trucks charged detention fees.[29]

Lost Revenue

Every hour of detention represents lost revenue that could have otherwise been earned. Table 8 shows the average trucking revenue per hour in 2023 from ATRI's *Operational Costs* report with fuel removed, since fuel surcharge revenues directly offset fuel costs, discussed in greater detail below.[30]

Even when customers pay detention invoices, detention fees do not fully cover the revenue that might have been earned during the same time. Surveyed carriers reported increasing their detention fees by a median of just 3 percent over the past 5 years (2018 to 2023). This rate of increase is well below that of inflation and of the hourly cost of trucking during the same period, which rose by 21.4 percent.[31]

[29] Erin Speltz and Dan Murray, "Driver Detention Impacts on Safety and Productivity," American Transportation Research Institute (September 2019), https://truckingresearch.org/2019/09/driver-detention-impacts-on-safety-and-productivity/.
[30] Revenue per hour was calculated by taking an average of carriers' total revenue divided by their total mileage and then multiplying by the average truck speed. See Footnote 12. Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.
[31] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.

The median detention fee for each sector in 2023 is shown in Table 8. Truckload carriers had the lowest detention fee at $50 per hour, while specialized fleets invoiced the highest at $80 per hour. Each of these fees is well below the total revenue that carriers could have otherwise received. The difference between the two, also shown in Table 8, is the revenue lost each hour even when customers pay detention fees.

Table 8: Median Detention Fee and Lost Revenue per Reimbursed Hour

Sector	Revenue per Hour*	Median Detention Fee per Hour	Lost Revenue per Reimbursed Hour
Refrigerated	$111.32	$60	$51.32
Specialized	$131.83	$80	$51.83
Truckload	$99.54	$50	$49.54

*Does not include fuel.

The hours corresponding to these two lost revenue figures – representing the portion of detention that is reimbursed and that which is unreimbursed – are shown in Table 9, based on the percentages of reimbursed stops (Table 7) and the total hours of detention per driver/truck (Table 3).[32]

Table 9: Annual Hours of Reimbursed vs Unreimbursed Detention per Driver/Truck

Sector	Total Annual Hours of Detention per Driver/Truck	Hours and Percentage of Reimbursed Detention	Hours and Percentage of Unreimbursed Detention
Refrigerated	209.4	75.4 (36.0%)	134.0 (64.0%)
Specialized	117.5	53.9 (45.9%)	63.6 (54.1%)
Truckload	173.0	75.3 (43.5%)	97.7 (56.5%)

Table 10 calculates the lost annual revenue per driver for each sector, based on the hours of detention per driver (Table 3), the revenues for reimbursed and unreimbursed detention in (Table 8), and the number of reimbursed and unreimbursed detention hours (Table 9).[33] Finally, it estimates each sector's total lost revenue by multiplying the sector's lost revenue per driver by its size (Table 4).

[32] This calculation assumes an equivalent payment of detention fees across all detention hours, regardless of the length of each incident. While such an assumption may be limited, it was the best possible choice given the available data.

[33] To do so, the two hourly lost revenue figures in Table 8 – unreimbursed and partially reimbursed – were first multiplied by the number of annual hours lost per driver in each respective category in Table 9. These two products were then summed to determine the lost revenue per driver.

Table 10: Annual Lost Revenue

Sector	Lost Revenue per Driver	Total Lost Revenue
Refrigerated	$18,786.41	**$2,041,932,476**
Specialized	$11,178.03	**$3,835,573,324**
Truckload	$13,455.42	**$5,663,157,536**

The for-hire trucking industry lost as much as $11.5 billion in revenue due to detention at customer facilities in 2023. While revenue is partly dependent on shipping rates and industry capacity, these lost dollar figures represent the real economic constraint that detention poses to revenue streams and growth in the trucking industry given its asset-heavy nature.

Fuel Costs

Most carriers foot the bill for fuel consumed while waiting at customer facilities, since most fuel surcharge contracts are determined by the mile. The primary cause of fuel consumption at customer facilities is idling.

Drivers often leave their trucks idling while at customer facilities due to customer facility requirements or conditions in the cab based on hot or cold weather. As described earlier in this report, drivers indicated that just 22 percent of customers have a waiting area, lounge, or break room available for drivers to use while detained, resulting in drivers having to wait in their vehicles. Whatever the cause, idling is a serious financial drain.

Estimates on a truck-tractor's fuel consumption vary according to auxiliary systems (such as air conditioning), load, and engine speed. Running at fewer revolutions per minute (RPM) consumes less fuel but creates additional engine wear and thus additional repair and maintenance needs. Research from the Argonne National Laboratory and American Trucking Associations' Technology and Maintenance Council suggests that a Class 8 truck consumes between 0.64 and 1.15 gallons per hour for an annualized figure of 0.8 gallons per hour, corresponding to approximately 900 RPM with air conditioning on half of the time.[34]

Table 11 estimates the gallons of diesel consumed in detention. It is assumed that drivers idle during 50 percent of their detention hours annually (Table 3) at the 0.8 gallons-per-hour average idling fuel economy. Table 11 then calculates the total cost of fuel per driver/truck using the Energy Information Administration (EIA) 2023 annual average diesel price per gallon of $4.214.[35]

[34] Linda Gaines and Patricia Weikersheimer, "Idling Reduction for Long-Haul Trucks: An Economic Comparison of On-Board and Wayside Technologies," Argonne National Laboratory (September 2016), https://anl.app.box.com/s/ordxowhhcqrp7fe3yd3oy2fqpwt3fpiw; "Analysis of Costs from Idling and Parasitic Devices for Heavy Duty Trucks," American Trucking Associations Technology and Maintenance Council (2003); "How Much Fuel is Used for Idling?" Argonne National Laboratory (2014), https://www.anl.gov/sites/www/files/2018-02/idling_worksheet.pdf.

[35] "Weekly Retail Gasoline and Diesel Prices," U.S. Energy Information Administration (accessed August 2024), https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_a.htm.

Table 11: Annual Cost of Fuel Wasted during Detention per Driver

Sector	Diesel Wasted	Cost of Wasted Diesel
Refrigerated Truck	83.8 Gal	$353.13
Refrigerated Trailer[36]	167.5 Gal	$617.07
Specialized	47 Gal	$198.06
Truckload	69.2 Gal	$291.61

Table 12 converts each of the per-driver/truck numbers from Table 11 into national totals using the estimated industry sizes in Table 4 and sums them for industry-wide totals. In 2023, the trucking industry spent approximately $286.1 million on diesel while idling during detention alone, not including the first two hours of dwell time at each stop.

Table 12: Total Annual Cost of Fuel Wasted during Detention

Sector	Diesel Wasted (Gallons)	Cost of Wasted Diesel
Refrigerated Trucks	9,108,390	$38,382,406
Refrigerated Trailers	18,205,910	$67,070,572
Specialized	16,127,345	$67,961,318
Truckload	29,125,104	$112,733,692
Overall	**72,566,749**	**$286,147,988**

Total Lost Expenses

Fuel is not the only expense that accrues during detention. Aside from the business and revenue lost, carriers must continue to pay certain expenses even when a truck is not moving.

In addition to fuel and driver detention pay, additional costs are still incurred while a driver is detained.

- Driver benefits are still paid.
- Permit costs are still paid.
- Insurance premiums are influenced in large part by exposure, but annual premiums remain fixed regardless of how much detention occurs.
- Truck and trailer lease or purchase payments must still be made; even carriers that purchase their equipment outright incur additional engine wear that shortens the life of the engine prior to overhaul, the point at which many carriers sell trucks.

[36] The cost calculation assumes that the refrigerated trailer runs 100 percent of the time that the driver is detained. Refrigerated trailers use off-highway diesel, however, which does not include the taxes assessed on standard diesel. Based on July 2023 tax rates, an assumed off-highway diesel price of $3.684 per gallon was used. "State-by-State Fuel Taxes," U.S. Energy Information Administration (July 2023), https://www.eia.gov/tools/faqs/faq.php?id=10&t=9.

Based on ATRI's 2023 *Operational Costs of Trucking* report, costs (excluding fuel and driver detention pay) impacted by detention totaled $26.45 for refrigerated carriers, $25.96 for specialized carriers, and $26.58 for truckload carriers.[37] For every additional hour in which a truck is detained instead of being in normal operations (i.e. driving or loading/unloading), it is assumed that carriers must still pay these costs at the standard hourly average.

Table 13 lists the annual total costs of detention, on a per-driver basis, for the cost of driver detention pay (Table 6), lost diesel (Table 11), and the remaining costs impacted by detention. The final column of Table 13 calculates the annual unreimbursed costs of detention paid by carriers per driver by subtracting these three cost categories from the total detention fees received from customers (Tables 8 and 9).

Table 13: Annual Costs of Detention per Driver

Sector	EXPENSE: Driver Detention Pay	EXPENSE: Wasted Diesel	EXPENSE: Additional Detention-Impacted Costs	REVENUE: Detention Fees Received	TOTAL: Unreimbursed Costs of Detention
Refrigerated	$4,188.00	$970.20	$5,538.63	$4,524.00	**$6,172.83**
Specialized	$3,407.50	$198.06	$3,050.30	$4,312.00	**$2,343.86**
Truckload	$3,979.00	$291.61	$4,598.34	$3,765.00	**$5,103.95**

As shown in Table 13, the detention fees that customers pay carriers are far less than the expenses that carriers actually incur during detention. In the case of the refrigerated and truckload sectors, customer detention fees cover less than half of carriers' expenses; in the case of specialized carriers, fees cover less than two-thirds of carriers' expenses. This disparity likely reflects the fact, mentioned earlier, that surveyed carriers increased detention fees by a median of just 3 percent from 2018 to 2023 – a period in which the hourly costs of trucking increased by 21.4 percent.[38]

Finally, these per-driver costs were used to calculate the total annual unreimbursed costs of detention for each sector (via sector sizes in Table 4).

- Refrigerated operations lost an estimated **$670,937,238** in detention during 2023.
- Specialized operations lost an estimated **$804,260,401** in detention during 2023.
- Truckload operations lost an estimated **$2,148,165,788** in detention during 2023.
- Overall, the trucking industry lost an estimated **$3,623,363,427** in detention during 2023.

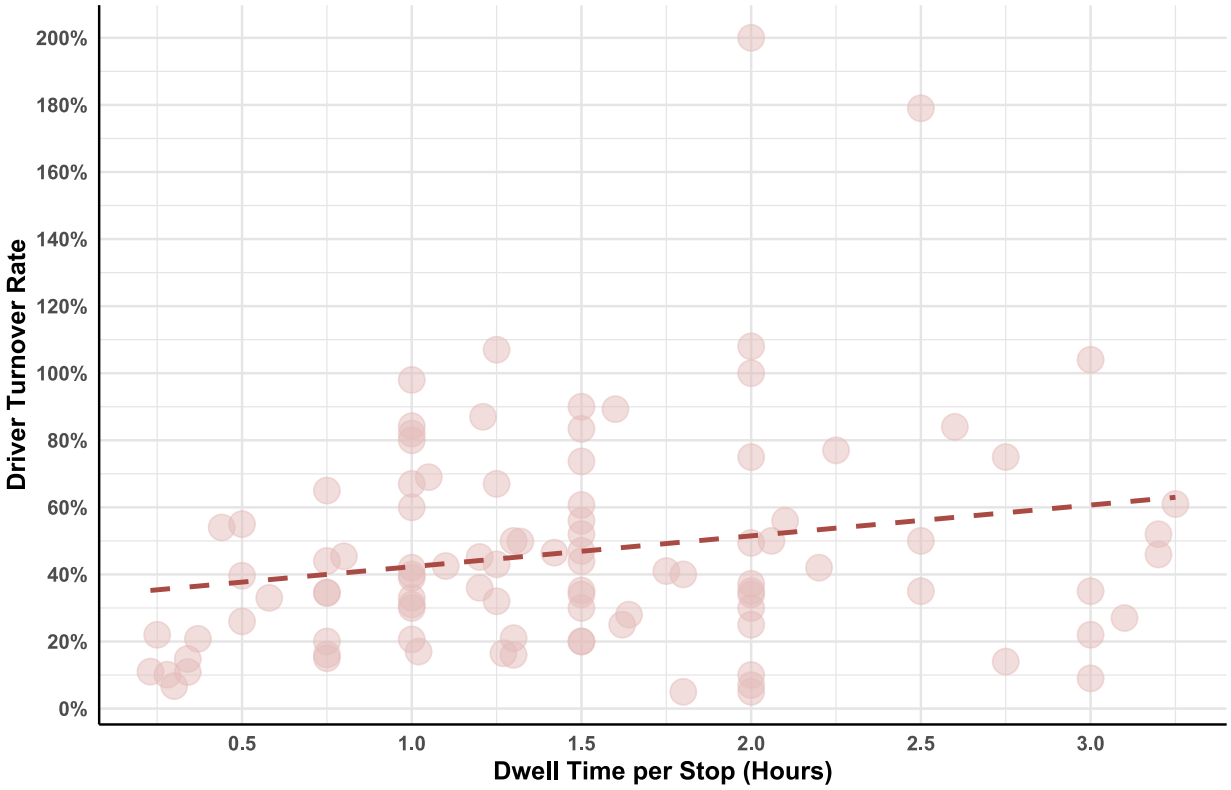
[37] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.
[38] Ibid.

Driver Turnover

Driver detention has numerous other negative impacts on carriers, one of the most prominent being driver turnover. As discussed above, 34.6 percent of surveyed drivers reported that they had left a previous carrier due to excessive or undercompensated detention time.

Linear regression was performed on data from ATRI's *Operational Costs of Trucking* to investigate the relationship between dwell times and turnover, as depicted in Figure 10. As the variability in this figure indicates, driver turnover is impacted by a variety of factors from operational conditions to company culture to economic externalities, along with driver detention. Carriers that had lower average dwell times were found to have lower turnover rates with a high level of statistical significance ($p < 0.05$). Figure 10 shows a dotted regression line to indicate the average impact of average dwell time on turnover.

Figure 10: Impact of Average Dwell Time on Annualized Driver Turnover



In order to counter the effect of dwell times on turnover, carriers may need to pursue other strategies statistically associated with lower turnover.[39] Some of these strategies – including raising per-mile driver compensation or reducing annual mileage – may result in undesirable consequences for customers, such as higher rates or lower capacity.

[39] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.

UNDERSTANDING THE RELATIONSHIP BETWEEN DETENTION AND TRUCK SPEEDS

Since driver detention impacts myriad aspects of driver and truck operations, the research team analyzed the relationship between driver detention and the pre- and post-detained truck speeds. This analysis used ATRI's large database of truck GPS data and geofenced customer facilities, which were then stratified by customer type. One theory that is often raised is that detained truck drivers may "make up for lost time" by driving faster. There is evidence for this theory in a 2018 U.S. DOT Inspector General report that estimated that an extra 15 minutes of average dwell time (whether detention or not) corresponded to a 6.2 percent higher average crash rate.[40] The behavioral responses linking these events, however, is not well understood. Further insight into how detention times might correlate with driving speed, before or after reaching a facility, is of particular interest.

To identify the impact of detention on driving speed, research partner NCSU, led by NCSU principal investigator Yue Shan, analyzed driving speeds by length of detained time by customer facility types; metrics were then presented for detained versus not detained truck drivers. ATRI's truck GPS data were used from two periods in 2022, May 1 to May 30 and October 1 to October 31. Nine diverse customer facilities (food processors, semiconductors, chemicals, and distribution centers) and three types of trucks (refrigerated trucks, tank trucks, and dry van trucks) were considered. For consistency with other metrics in this report, the researchers defined "detained" as any time over two hours that a truck remained at a facility per visit.

Table 14: Detention Rates across Facility Types

Type of Facility	Number of Facilities	Truck Types	Number of Average Monthly Visits[41]	Average Monthly Detentions		Average Detentions by Month (%)	
				%	Number	May	October
Food Processors	4	Refrigerated, Dry Van, Tank	287.8	17.2%	49.4	10.1%	26.1%
Semiconductor Devices	2	Refrigerated, Dry Van	427.5	14.6%	62.5	13.9%	15.2%
Chemical	1	Tank	37.5	41.3%	15.5	17.2%	56.5%
Distribution Centers	2	Dry Van	1163.3	29.9%	348	30.6%	29.3%

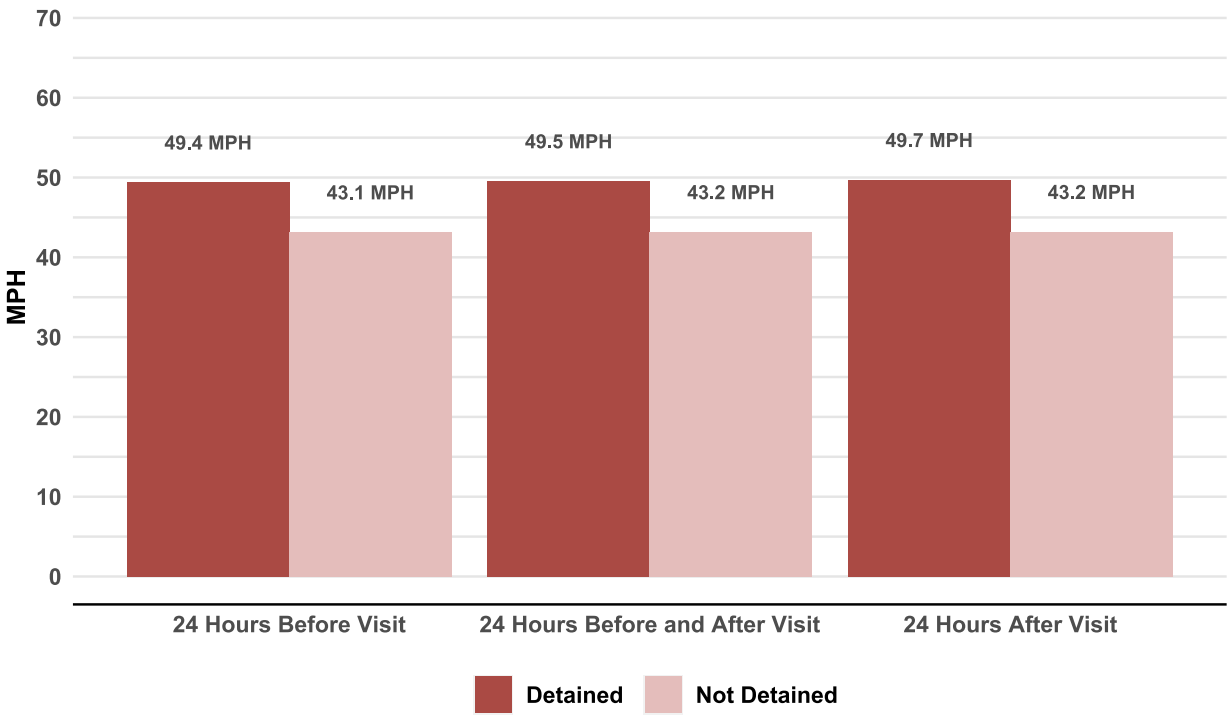
As shown in Table 14, trucks visiting chemical facilities experience high average monthly detention rates (41.3%), indicating more severe detention conditions compared to other types of customer facilities. Drivers visiting distribution centers in the dataset had the second-highest rate of detention (29.9%), which closely aligns with truckload dry van detention rates reported in the driver and carrier surveys (Figures 7 and 9). Detention rates vary considerably across time

[40] "Estimates Show Commercial Driver Detention Increases Crash Risks and Costs, but Current Data Limit Further Analysis," U.S. Department of Transportation Office of Inspector General (January 31, 2018), https://www.oig.dot.gov/sites/default/files/FMCSA%20Driver%20Detention%20Final%20Report.pdf.
[41] Simple average across facilities and both months (May and October).

of year; for all facility types except distribution centers, detention rates are much higher in October than in May, corresponding with peak shipping season.

Separating the dataset into detained and not-detained subgroups enabled a comparison of the driving speed between these groups. The average moving speeds were compared across three periods: 1) the 24-hour period before a visit; (2) 24 hours before and 24 hours after a facility visit (48 hours); and (3) the 24-hour period after a visit. As shown in Figure 11, detained trucks drive faster than non-detained trucks across all three of these periods, and the difference in these average speeds is statistically significant (95% CI). In the full 48-hour period, all truck drivers have 14.6 percent higher average speeds when detained than when not detained.

Figure 11: Average Speed Comparison between Detained and Not-Detained Trucks



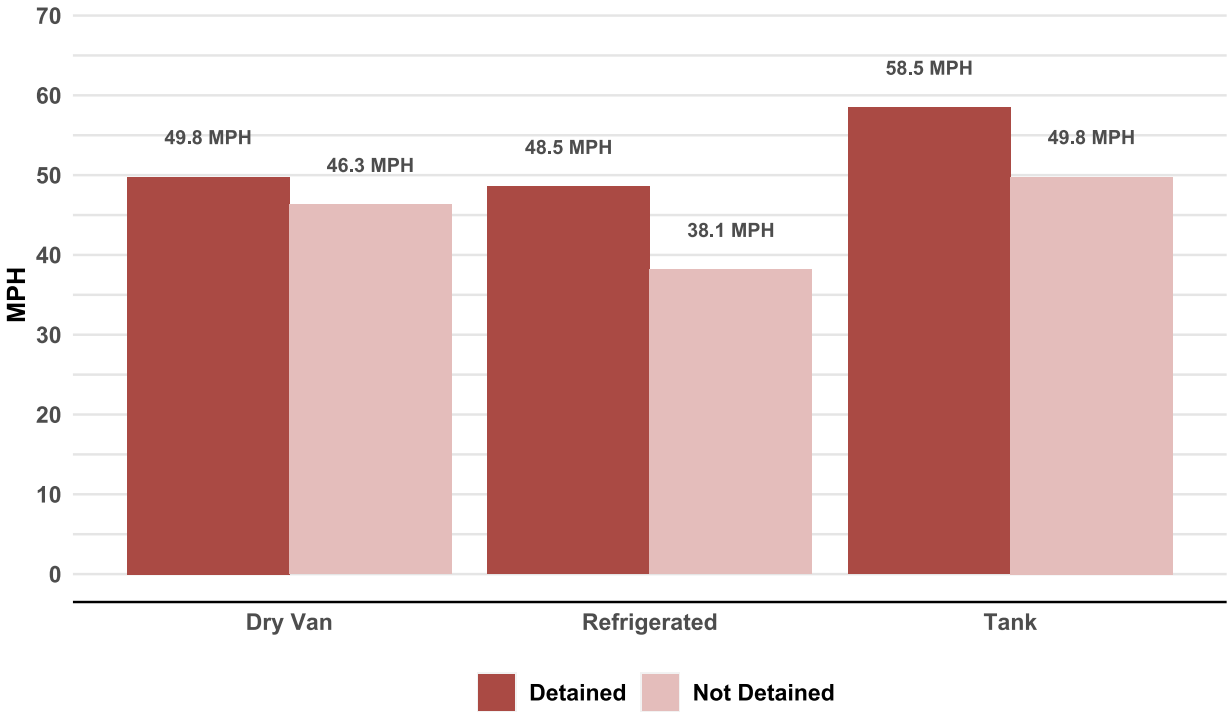
Differences in maximum speeds were also tested, but they were found to be smaller than the differences in average speeds. This may be partly explained by speed governors, which were used by 88 percent of carriers in 2023.[42] While some governed trucks may only be able to run slightly faster than a 65 MPH speed limit, drivers are able to drive faster relative to a 45 MPH speed limit. This finding – that differences in average speed were greater than differences in maximum speed – may suggest that detention-related speeding may occur more often on non-highway roads.

[42] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2024 Update*, American Transportation Research Institute (June 2024), https://truckingresearch.org/2024/06/an-analysis-of-the-operational-costs-of-trucking-2024-update/.

Figure 11 also shows that detained truck drivers drive faster, on average and with statistical significance, in the 24 hours before visiting a facility, compared to not-detained drivers. Two scenarios may explain this finding. First, drivers might anticipate through experience (their own or that of others) that they may be detained at a particular upcoming facility and may try to get an earlier spot in queue. This would be consistent with the anecdotal evidence from ATRI's driver survey, in which drivers reported arriving early and communicating with fellow drivers about detention-prone customers as a means of avoiding detention. Second, drivers may have higher average speeds prior to being detained because they were already behind schedule – potentially due to detention at a prior stop based on the 57.8 percent of truck drivers who indicated they were late or had to cancel an appointment due to detention in 2023 (Figure 5). Both scenarios suggest that detention may have a pervasive, systemic impact on the behavior of truck drivers, who are forced to both react and anticipate these significant delays on a regular basis.

To further examine the patterns in driving behavior in the 48 hours before and after being detained, three types of trucks were considered separately: refrigerated, tank, and dry van.[43] As shown in Figure 12, trucks of all three types have statistically significant differences in speed when they are detained as compared to when they are not detained (95% CI).

Figure 12: Average Speed Comparison between Detained and Not-Detained Trucks by Sector

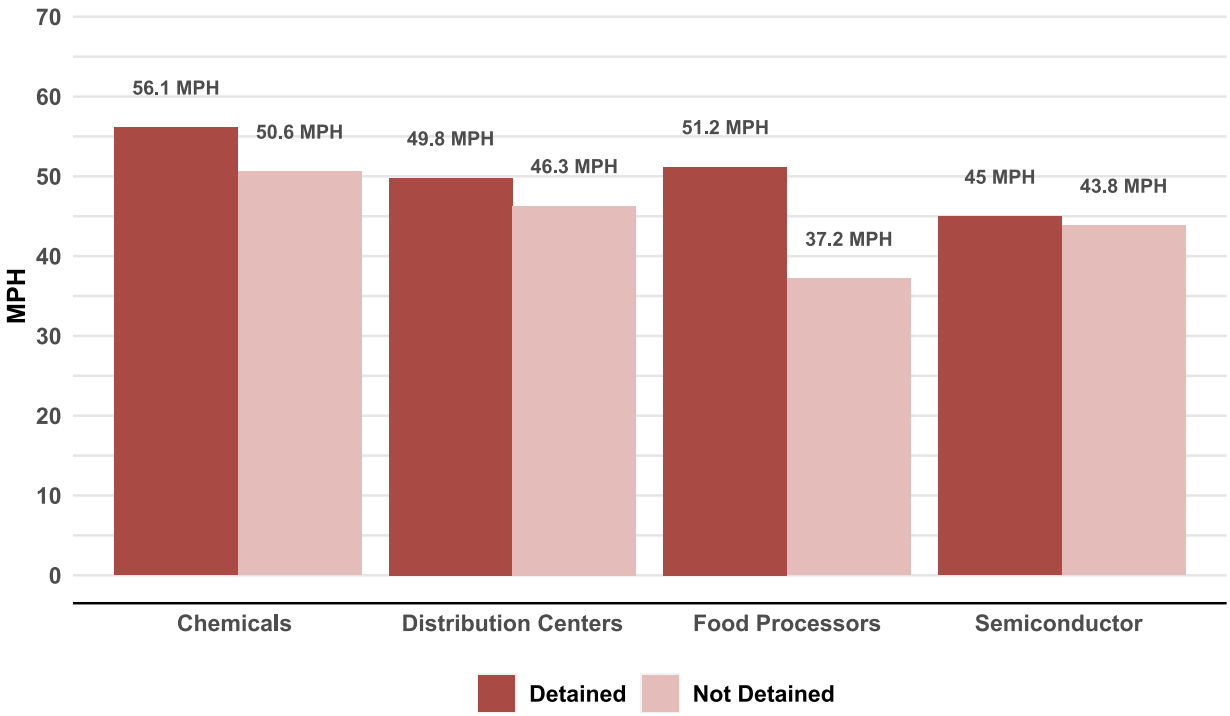


[43] Sector was assumed based on facility type. To avoid possible correlation concerns, two facilities in the dataset that were visited by both refrigerated and dry van trucks were excluded from this analysis. All other facilities included in this portion of the analysis were visited by only one type of truck.

Truckload dry van drivers had a 7.6 percent higher average speed when they were detained than when they were not detained. Refrigerated drivers have an even greater average speed differential – driving 27.3 percent faster when they are detained versus not detained. This may be explained by the fact that refrigerated truck drivers had the lowest baseline (not detained) speed among the three truck types, giving them more potential to increase their speed when detained. Refrigerated drivers are thus both detained more often and more susceptible to higher speeds when they are detained. Tank drivers had a 17.5 percent higher average speed when they were detained than when they were not detained.

Finally, the average speeds for detained and not-detained trucks were examined for each type of facility (Figure 13). A variety of truck types visit food processors (refrigerated, dry van, and tank) and semiconductor facilities (refrigerated and dry van), whereas only one type of truck visits chemical facilities (tank) and distribution centers (dry van). Detained trucks at distribution centers have 7.6 percent higher speeds than trucks that were not detained, and those detained at food processing facilities have 37.6 higher speeds than trucks at food processing facilities that were not detained. Both of these differences were statistically significant (95% CI).

Figure 13: Average Speed Comparison between Detained and Not-Detained Trucks by Facility Types



There was no significant difference in the average speeds of detained versus not-detained trucks visiting chemical or semiconductor facilities, even though average speeds were slightly higher when detained vs not detained. In the case of chemical facilities, this may be due to the relatively small sample size of stops per month (Table 14). In the case of semiconductor facilities, the lack of significant difference in average speeds may be due to the greater value and priority of these commodities.

The findings of this section suggest that detention has wide-reaching impacts on driver behavior, beginning up to 24 hours before a stop if a truck driver expects to be detained and lasting 24 hours after detention. Speeding is consistently a top factor recorded in large truck fatal crashes; in 2021, speeding was a driver-related factor in 7 percent of fatal large truck crashes.[44] Accordingly, given that detained trucks exhibit significantly higher speeds in every sector and at most facility types, detention could pose a safety risk.

[44] Federal Motor Carrier Safety Administration, *Large Truck and Bus Facts 2021* (November 2023), https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2023-12/LTBCF%202021-FINAL%20508_0.pdf.

CONCLUSIONS

Driver detention is a significant drain on the trucking industry, and yet the full extent of its consequences has not been fully understood. This report utilized driver and motor carrier surveys alongside a variety of industry and economic data to quantify the myriad ways in which detention costs drivers, carriers, and customers. A related assessment utilized ATRI's truck GPS data to determine whether driver detention has an impact on safety, through an analysis of truck speeds. Findings are summarized in Table 15.

Table 15: Findings

Detention is improving slightly but still pervasive.	Though the frequency of stops with detention dropped by 6.5 percentage points between 2014 and 2023, drivers still experienced detention in 39.3 percent of all stops. Drivers experienced detention times of more than four hours in 4.9 percent of all stops.
The frequency and duration of detention varies by operation and demographics.	Refrigerated drivers experienced detention on 56.2 percent of stops, far higher than the industry average. Women experienced detention on 49.1 percent of stops compared with 37.2 percent of stops for men – a statistically significant difference. Spot market freight was also more likely to experience detention, with 42.5 percent of stops detained compared with 33.8 percent of contract freight detained.
Drivers lose considerable time and pay while detained each year.	Refrigerated drivers lose 209.4 hours per year, specialized drivers lose 117.5 hours per year, and truckload drivers lose 173.0 hours per year.
Detention pay does not fully compensate drivers' lost time.	Refrigerated drivers lose $1,283.62 per year in income, specialized drivers lose $640.38 per year, and truckload drivers lose $889.22 per year. These dollar figures amount to between 0.9 and 1.6 percent of drivers' total annual pay.
The for-hire trucking industry lost 135.9 million hours to detention in 2023.	Refrigerated operations lost 22.8 million productive hours, specialized operations lost 40.3 million productive hours, and truckload operations lost 72.8 million productive hours.
Though most carriers have some form of detention fee, this fee is often not billed and/or not paid.	Carriers only invoice customers 75 percent of the time, and even when they do, only 55 percent of those invoices are paid. Ultimately, refrigerated carriers received detention fees for just 36 percent of all detention incidents, specialized carriers received detention fees for 45.9 percent of all detention incidents, and truckload carriers received detention fees for 43.5 percent of all detention incidents.
The for-hire trucking industry lost $11.5 billion in revenue to detention in 2023.	Detention-imposed lost revenue totaled $2.0 billion for refrigerated operations, $3.8 billion for specialized operations and $5.7 billion for truckload operations.
Fuel wasted while idling as drivers are detained creates significant costs for the industry.	The industry wasted over 72 million gallons of diesel while detained in 2023, costing the industry over $286.1 million.
The for-hire trucking industry lost $3.6 billion in unreimbursed expenses during detention in 2023.	Refrigerated operations lost $671 million in unreimbursed expenses, specialized operations lost $804 million in unreimbursed expenses, and truckload operations lost $2.1 billion in unreimbursed expenses.

Detention causes driver turnover, and inefficient asset use.	Carriers with longer average dwell times had higher driver turnover rates with a high level of statistical significance. Additionally, inefficient asset use is yet another outcome of detention: truckload freight demand could be accommodated with 7.4 percent fewer trucks if detention were eliminated.
Detention poses a safety risk.	Drivers that are detained drive 14.6 percent faster on average than drivers that were not detained.

The negative consequences of detention therefore impact not only motor carriers and drivers but freight customers and their consumers. While there is no one-size-fits-all solution to this problem, this research has shown that any efforts made to curb detention will yield immediate cost and productivity benefits throughout the supply chain. ATRI's research did identify several strategies for reducing driver detention.

Strategies for Reducing Driver Detention

Carrier survey respondents were also asked to share any successful strategies that they have used to reduce detention. Responses to this question were summarized into five categories.

1. Negotiate Detention Fees

   Unfortunately, motor carriers often have limited ability to negotiate detention fees. This is especially true for small carriers with less leverage, shipments for the food services industry where detention is particularly rampant, or during soft freight markets in which customers have more negotiating power. OOs and carriers that work primarily through brokers or the spot market may have even less opportunity for negotiation. Where possible, some carrier respondents recommended negotiating for higher fees for especially long or frequent detention as another tool for incentivizing customers to reduce detention. Given that detention fees have lagged behind the rising costs of trucking in general, negotiation is an important task for all carriers.

2. Arrive Early

   By arriving early to an appointment, drivers may be able to limit detention by being the first in line to be loaded or unloaded. The potential utility of this approach depends on the scheduled appointment time being either at the start of the workday or prior to times at which the customer facility is historically busy. The downside of arriving early is that this strategy still places the onus on drivers to spend time waiting at customer facilities and plan their schedules around doing so. In addition, there are instances in which carriers have been fined for arriving early.

3. Trailer-Based Approaches

   Drop-and-hook or "no-touch" shipments, in which a trailer is simply picked up or dropped off at a customer facility, are less susceptible to detention. By contrast, live load or unload shipments require drivers to wait (or assist) with trailers as commodities are taken on or off. Delays with drop-and-hook activities are still possible if, for example, a trailer has not been

loaded prior to scheduled arrival, there is no available space at the facility for a driver to access or leave the trailer, or there are no available personnel to direct the driver to the correct location of the trailer. Another approach that carriers use is to expand their own trailer pools that they can utilize for drop-and-hook arrangements. This approach requires additional investment in equipment, but it may provide other operational benefits outside of detention prevention.

4. Communication

   There are several goals of clear, quick communication with customers. The first is to remain apprised, in real-time, of any delays at customer facilities. The second is to quickly report any detention incident details to carrier staff, brokers, or customers as soon as possible. OOs and small fleets shared that it can be a challenge to report detention quickly, however, when detention has already put them behind schedule. Finally, it is important for carriers to continue their efforts to educate customers on the operational challenges and costs associated with detention – costs that carriers and customers share alike. As ATRI research with customers revealed, many customers simply are not aware of how much detention occurs at their facilities.

5. Refuse Service

   Ultimately, one option available to carriers is to refuse to work with customers that persistently cause detention and remain apathetic toward addressing it. Yet even this course of action is often untenable; truckload and refrigerated carrier respondents reported that detention would need to take place on a median 50 percent of stops or more before refusing service, and specialized carrier respondents reported 30 percent of stops detained as their threshold for refusing service.

When asked to share their strategies for reducing detention time, customers affirmed many of the same strategies of carriers, including the maximization of drop-trailer usage and encouraging early arrival.

In addition to highlighting issues of staffing or product availability, customers emphasized the need to improve scheduling and yard management systems – an area receiving additional attention from industry groups such as the Scheduling Standards Consortium.[45]

Finally, customers encouraged communication with carriers that extends beyond simply notifying when facility delays could lead to detention. These customers recommended working with carriers to access better data on detention, which carriers can often obtain more easily through ELDs, and the financial benefits of reducing detention time.

[45] For more information, visit https://www.freightapis.org/.

APPENDIX A: DRIVER SURVEY

The American Transportation Research Institute (ATRI), the trucking industry's not-for-profit research organization, is studying the various impacts that truck driver detention has on supply chains. ATRI's Research Advisory Committee (RAC), which includes truck driver organizations, identified this issue as a top industry priority in 2023.

This survey asks drivers to provide input on their experience with several different components of driver detention. Responses will be incorporated into research that identifies solutions for managing and reducing truck driver detention. All responses will be kept completely **confidential**.

You can also complete the survey online here - **https://www.research.net/r/Driver-Detention-Survey**

Demographics

1. **What is your gender?**
   - ❑ Woman
   - ❑ Man
   - ❑ Non-binary
   - ❑ Prefer not to answer

2. **What is your age?**

   ____

3. **How many years of professional driving experience do you have?**

   ____

4. **What is your employment status?** (check one)
   - ❑ Employee Driver
   - ❑ Owner-Operator with own authority
   - ❑ Owner-Operator/Independent Contractor leased to motor carrier

5. **In which sector of the trucking industry do you operate?** (check one)
   - ❑ For-hire
   - ❑ Private
   - ❑ Don't know

6. **If you operate in the for-hire sector, what is your primary type of business?** (check one)
   - ❑ Truckload
   - ❑ Less-than-truckload
   - ❑ Specialized
   - ❑ Other (please specify): _____

7. **What is the primary vehicle configuration that you typically drive? (check one)**
   - ❑ 5-axle Dry Van
   - ❑ 5-axle Refrigerated Trailer
   - ❑ 5-axle Flatbed
   - ❑ 5-axle Tanker/HazMat
   - ❑ 5-axle Bulk/Food
   - ❑ Straight Truck
   - ❑ Longer Combination Vehicles (Doubles, Triples, etc.)
   - ❑ Other (please specify): _____

8. **How many power units are operated by your fleet?** *(check one)*
   - ❑ Less than 5
   - ❑ 6-15
   - ❑ 16-50
   - ❑ 51-250
   - ❑ 251-500
   - ❑ 501-1000
   - ❑ 1,000+
   - ❑ Don't know

9. **What is your average length of haul?** (check one)
   - ❑ Local (less than 100 miles per trip)
   - ❑ Regional (100-499 miles per trip)
   - ❑ Inter-regional (500-999 miles per trip)
   - ❑ Long-Haul (1,000+ miles per trip)

10. **How are you primarily paid?** (check one)
    - ❑ Per hour
    - ❑ Percentage of freight bill
    - ❑ Per load
    - ❑ Per mile
    - ❑ Other (please specify): _____

Detention

11. **Please estimate what percent of your stops had the following delay times in 2023.** Do not include scheduled breaks or early arrival. *(total must sum to 100%)*

Delay Time	% (should total 100%)
0-30 Minutes	
30-60 Minutes	%
1-2 Hours	%
2-3 Hours	%
3-4 Hours	%
4-6 Hours	%
6+ Hours	%
Total =	100%

12. **How many stops per week did you make at customer facilities (shippers + receivers) in 2023 on average?**

_____

13. **Does the company you drive for provide driver detention pay for excessive delays?**
❑ Yes
❑ No

14. **If yes, how much time must pass after the scheduled arrival before detention pay starts?**

_____ hours

15. **What is the detention pay rate?** *If you receive different rates based on load source or type, please estimate the average hourly rate (USD).*

USD _____ per hour

16. **If you are a solo driver, in 2023, how many times did you run out of available on-duty hours unexpectedly *while at a shipping or receiving facility* as a result of being detained at a customer's facility?** *If this did not happen to you, write "0."*

_____

17. **If you are a solo driver, in 2023, how many times were you late to or had to cancel your next scheduled pick-up or delivery as a result of being detained at a customer's facility?** *If this did not happen to you, write "0."*

_____

18. **What percent of customer facilities that you visited in 2023 allow you to park in the facility while waiting to load/unload?**

____ %

19. **What percent of customer facilities that you visited in 2023 allow you to use the bathroom?**

____ %

20. **What percent of customer facilities that you visited in 2023 have a truck driver lounge or waiting area?**

____ %

21. **Have you left a previous job as a driver due to excessive or undercompensated detention time?**
❑ Yes
❑ No

22. **How frequent would detention – delays of more than two hours – need to become for you to change jobs?**

_____% of stops

Thank you! We greatly appreciate your participation.

OPTIONAL: If you would like a copy of the final study, please provide the following:

Name: _____

Email Address: _____

APPENDIX B: MOTOR CARRIER AND OWNER-OPERATOR SURVEY

The American Transportation Research Institute (ATRI), the trucking industry's not-for-profit research organization, is studying the various impacts that truck driver detention has on drivers, motor carriers and supply chains in general.

ATRI's Research Advisory Committee (RAC) identified this issue as a top industry priority in early 2023. This survey asks motor carriers and owner-operators to provide input on several different components of driver detention. Responses will be incorporated into research that identifies solutions for managing and reducing truck driver detention.

All responses will be kept completely **confidential**. The final report will only be presented in an aggregated, non-identifying format.

1) Please enter your contact information below. Occasionally ATRI will follow up with participants to clarify answers. Your information will be kept strictly confidential**. All participants will receive an advance copy of the full report.**

Company	Contact Name
City, State	Position/Title
Phone	Email

2) What is your <u>primary</u> for-hire business operation type? *(Check only one)*

- □ Truckload Dry Van
- □ Less-Than-Truckload
- □ Refrigerated Van
- □ Tanker
- □ Flatbed
- □ Specialized – Oversize/Overweight
- □ Express / Parcel Service
- □ Intermodal Containers
- □ Automotive Transportation
- □ Household Goods Mover
- □ Bulk
- □ Other (please specify): _____

3) **What are the three <u>primary</u> types of commodities that your company hauls?** *(While your company may haul multiple commodities, select <u>only the top 3</u> most frequently hauled commodities.)*

- ☐ Agricultural Products
- ☐ Automotive Parts
- ☐ Construction/Building Materials
- ☐ Electronics
- ☐ Finished Vehicles
- ☐ Food Products – Refrigerated
- ☐ Food Products – Non-Refrigerated
- ☐ Forest Products / Wood
- ☐ Garbage or Sanitation
- ☐ General Freight
- ☐ Hazardous Materials
- ☐ Heavy Machinery / Equipment
- ☐ Household Goods
- ☐ Industrial Gases
- ☐ Intermodal Containers
- ☐ Livestock
- ☐ Manufactured Goods
- ☐ Mine Ores
- ☐ Modular/Mobile Homes
- ☐ Non-Hazardous Chemicals
- ☐ Paper Products
- ☐ Petroleum Products
- ☐ Pharmaceuticals
- ☐ Refrigerated Not-Food
- ☐ Retail Store / General Merchandise
- ☐ Steel / Metal Sheets, Coils, Etc.
- ☐ U.S. Mail/Parcel Service
- ☐ Other (please specify): _____

4) **What was your fleet's total IFTA mileage in 2023?** *(Include Owner-Operator miles reported for IFTA purposes; if your fleet does not report IFTA mileage, please enter your total mileage)*

_____

5) **What was your fleet's total number of truck-tractors in 2022?**

_____

6) **How many drivers did your company utilize in 2023 for each type of equipment?**

	Company Driver / Company Truck	Leased Driver / Company Truck	Owner-Operator
Truck-Tractor – Solo Driver			
Truck-Tractor – Team Drivers (Total number of team drivers)			

7) **What was your average TRUCK-TRACTOR total dwell time per stop at shipper/receiver facilities in 2023?** *Dwell time is defined as loading/unloading + detention; it should not include planned driver breaks or early arrival time.*

_____ hours per stop

8) **Please enter the percentage of your stops in each dwell time bin:**

0-1 Hours	1-2 Hours	2-3 Hours	3-4 Hours	4-5 Hours	5+ Hours
%	%	%	%	%	%

9) **If your fleet tracks detention time** (total dwell time minus time spent loading/unloading)**, what percent of total dwell time is detention time on average?**
_____%

10) What was your average number of stops at shipper/receiver facilities <u>per driver per week</u> in 2022?

_____ stops per driver per week

11) Please enter the following percentages:

	Percent of Total Loads	Percent of Loads Detained
Contract		
Spot		
	100%	

12) If you charge a detention fee to shippers,

- **How much time must elapse after the scheduled arrival before the detention fee begins?** *Please answer in hours*

  _____ hours

- **What is your total detention fee rate?** *Please answer in USD per hour*

  $____ per hour

13) By what percent have your shipper detention fee rates increased from 2018 to 2023?

___%

14) What percent of detention incidents *do you bill* for detention fees?

___ %

15) What percent of billed detention fees *do you receive*?

___ %

16) How frequent would detention need to become for you to stop working with a shipper/receiver?

___ % of a shipper's loads

17) Besides detention fees and cutting ties with a shipper/receiver, what other steps do you take to reduce detention?

_____

_____

_____

18) If you compensate drivers with detention pay,

- **How much time must elapse after the scheduled arrival before the detention pay begins?** *Please answer in hours*

  _____ hours

- **How much detention pay do you provide to your detained drivers?** *Please answer in USD per hour*

  $____ per hour

19) By what percent has your detention pay rate for drivers increased from 2018 to 2023?

___%

20) What percent of your customers allow drivers to park on their facility if:

They reach their maximum Hours of Service? ___%

They are waiting to load/unload? ___%

21) What was your company's annualized driver turnover rate in 2023? *Please answer as a percent*

_____%

22) What was your company's average driver pay per mile ($/mile) OR average driver pay per hour ($/hour) in 2023? *Do not include bonuses. If there are multiple pay and benefit rates for the same type of driver, please use the average pay and benefits rates.*

$ ___ per ___

23) Which strategies have you used that have been most successful in preventing / reducing driver detention?

_____

_____

_____

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